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FORTY-NINTH
REGULAR REPORT
OF THE
BOARD OF WATER COMMISSIONERS

WATER WORKS

TO THE
COMMON COUNCIL OF THE CITY OF DETROIT

FOR EIGHTEEN MONTHS
ENDING JUNE 30TH

1901.

Calvert Lith. Co. Detroit.

J. B. Davis.

FORTY-NINTH REGULAR REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE CITY OF DETROIT

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR EIGHTEEN MONTHS,

ENDING JUNE 30TH, 1901.

DETROIT FREE PRESS PRINTING COMPANY,
1901.

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THE BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

RATES JULY 1, 1900.

METER RATES.

Payable Quarterly.	QUARTERLY
First 30,000 gals	$1 75
All in excess of 30,000 gals	2¼ cts. per M.
Minimum Rate	1 75

ASSESSMENT RATES.

	PER ANNUM
For Family, household purposes	$2 60
Additional Families to first, in same house supplied through same faucet, each family	1 40
Green Houses.—Special rates.	
Private Stable, for each horse	1 20
Livery Stables, “ “ “	1 20
Dray and Team Horses, each	60
Cows, each	60
Stores and Offices, from	$1 00 to 12 00
Bakeries, average daily use for each barrel of flour	2 00
Groceries and Provision Stores, from	$3 00 to 50 00
Saloons, from	6 00 to 50 00
Bar, with faucet, from	8 00 to 50 00
Fish Houses, from	6 00 to 50 00
Beer Pump	2 00
Barber Shops, each chair	2 00
Slaughter Houses.—Special rates.	
Hotels and Taverns, in addition to family rate, each room	60
Boarding Schools, from	$4 00 to 50 00
Printing Offices.—Special rates.	
Butcher Stalls, each not less than	3 00
Workshops, for 10 persons or under	3 00
“ for each additional 10 persons	1 00
Boarding Houses, in addition to family rate, each boarder or roomer,	40
Estimated quantities of water each 1,000 gallons	07
Building Purposes, each 1 M brick	03
“ “ “ 100 yards plastering	05
“ “ “ perch stone	01
“ “ minimum	50

FIXTURES.

Bath Tub, for families, 1st tub	$1 00
“ “ each additional tub	60
“ “ public, each tub	4 00
Automatic Water Closets, for family, 1st closet	1 60
“ “ “ each additional	60
“ “ “ for hotels, stores, factories, etc., for 10 persons	2 00
“ “ “ each additional person	20
Rod Water Closets, not less than	6 00
Urinals, not less than	2 00
Wash Hand Basins, for family, each	50
“ “ “ for other purposes, each person	15
Hose Bibb or Connection, premises 30 feet front or less	60
“ “ “ “ 30 feet to 60 feet	80
“ “ “ “ 60 feet to 100 feet	1 60
Special Rates for larger grounds.	
Fountains	$5 00 to 20 00
Street Sprinklers, each wagon	50 00

Where there is a waste of water an increase of rates will be made.

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

MEMBERS:

JOSEPH J. NOEKER, 1902. EDWARD W. PENDLETON, 1904.
JOHN ZYNDA, 1903. DARIUS D. THORP, 1905.
JOSEPH J. CROWLEY, 1906.

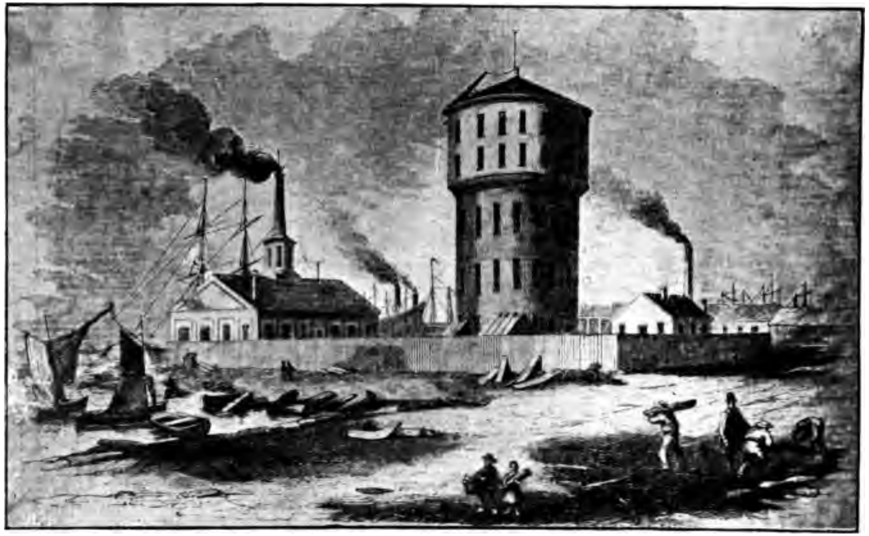
COMMITTEES:

WAYS AND MEANS	Commissioners PENDLETON, CROWLEY.
EXTENSION AND CONSTRUCTION,	Commissioners CROWLEY, PENDLETON.
PUMPING WORKS	Commissioners THORP, ZYNDA.
SUPPLIES	Commissioners ZYNDA, THORP.

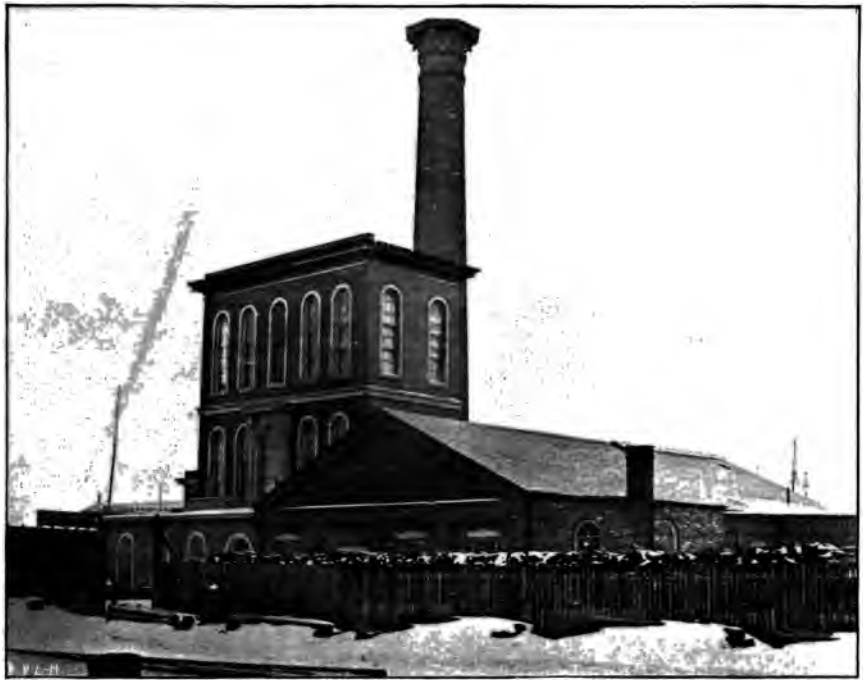
The President is ex-officio member of each committee.

OFFICERS:

PRESIDENT	JOSEPH J. NOEKER.
VICE-PRESIDENT	JOHN ZYNDA
GENERAL MANAGER	H. S. STARKEY.
SECRETARY	BENJ. F. GUINEY.
SUPERINTENDENT OF CONSTRUCTION	LUKE CROSSLEY.
SUPT. OF METERS AND INSPECTION	THOMAS R. PUTNAM.
CIVIL ENGINEER	CLARENCE W. HUBBELL.
CHIEF ENGINEER AT PUMPING WORKS	URIAH GOULD.
BOOKKEEPER	W. W. WILCOX.
RECEIVING CLERK	GEORGE E. KUNZE.
CASHIERS	S. G. ROOD. CHARLES W. KEENA.
METER CLERK	ARTHUR J. STORM.
PERMIT CLERK	GERALD P. MONAGHAN. FRANK PETZ. R. Z. ROUSSEAU. ANTHONY VOGEL.
COLLECTORS	ANTHONY J. LOOK. THOS. DALTON. GEORGE ADAMS. M. A. DETTLING. CHARLES M. PRESTON.
SUPT. STORAGE GROUNDS	R. J. ECHLIN.



1848 TO 1858.



1858 TO 1874.

VL-H

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

To the Honorable the Common Council of the City of Detroit:

The Board of Water Commissioners of the City of Detroit respectfully submits, herewith, its report for a period of one year and six months, ending June 30, 1901. The fiscal year has formerly coincided with the calendar year, but for purposes of convenience it has now been made to correspond with that of other departments of the city government.

All branches of this department are in a satisfactory condition. Special attention is called to the detailed reports of the various officers of the Board. Much of the efficiency in the administration of the various parts of the system is due to the competence of the heads of departments and to the faithfulness of many employes who have long been in the service of the Board.

The total receipts for the eighteen months, amounted to the sum of $936,738.06. The total expenditures for the

se plans comprise the installation of two high pressure nes, each with a daily capacity of 25,000,000 gallons, an additional 42-inch main, all of which are now under truction and will be in operation the coming summer. ddition to the pumping station is building and impor- improvements have been made in connection with the ly to the various engines.

order to meet the necessary expenditures for these vements an Act of the last legislature empowered the d, with the consent of the Common Council and the of Estimates, to issue bonds in the amount of $500,000.

he Act of the legislature empowering the Board to abutting property for the expense of laying pipe has declared unconstitutional by the Supreme Court and oneys collected, amounting to the sum of $13,992.65, been refunded through the City Treasurer.

e Supreme Court has also determined that water rates be collected for water furnished for public purposes provision therefor is made by the Board of Estimates. ecision does not apply to the Board of Education nor ouse of Correction, nor does it, in express terms, the Board to supply free water to the municipality expense of the general consumer. Either by mutual ment or under the control of the Supreme Court, quitable assessment should be allowed by the Board mates for water actually consumed by the city. It is mination to tax water consumers only and not the property of the city for a public good.

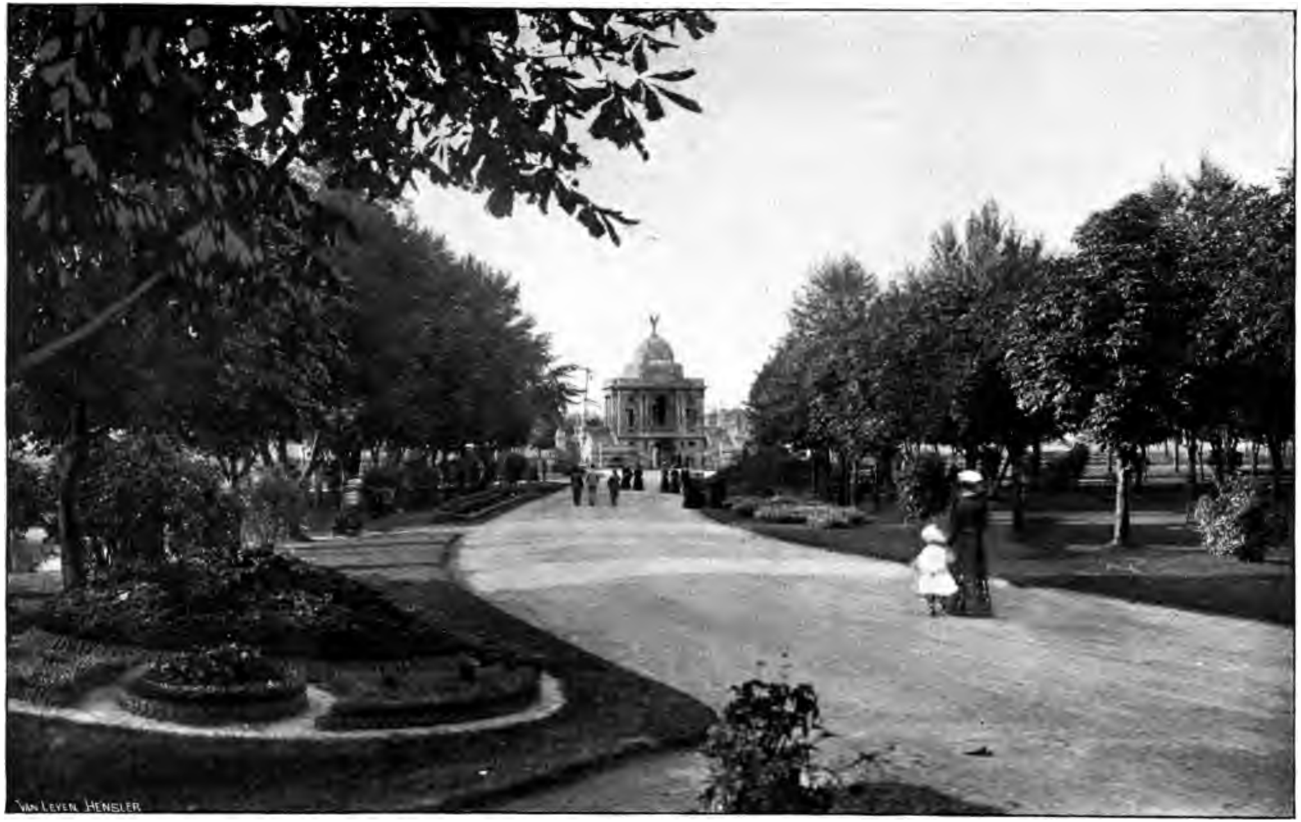
he administration of the trust submitted to our charge the careful investigation of your honorable body.

relations with all departments of the city government have been most amicable and the many courtesies that have been received are fully appreciated. Any suggestions for the promotion of the public good will be given careful attention: "In the multitude of counselors there is wisdom."

All of which is respectfully submitted.

JOSEPH J. NOEKER,
JOHN ZYNDA,
EDWARD W. PENDLETON,
DARIUS D. THORP,
JOSEPH J. CROWLEY,
The Board of Water Commissioners of the City of Detroit.

JULY 1, 1901.



HURLBUT MEMORIAL GATE.

REPORT OF THE SECRETARY.

Detroit, Mich., July 1st, 1901.

To the Board of Water Commissioners of the City of Detroit:

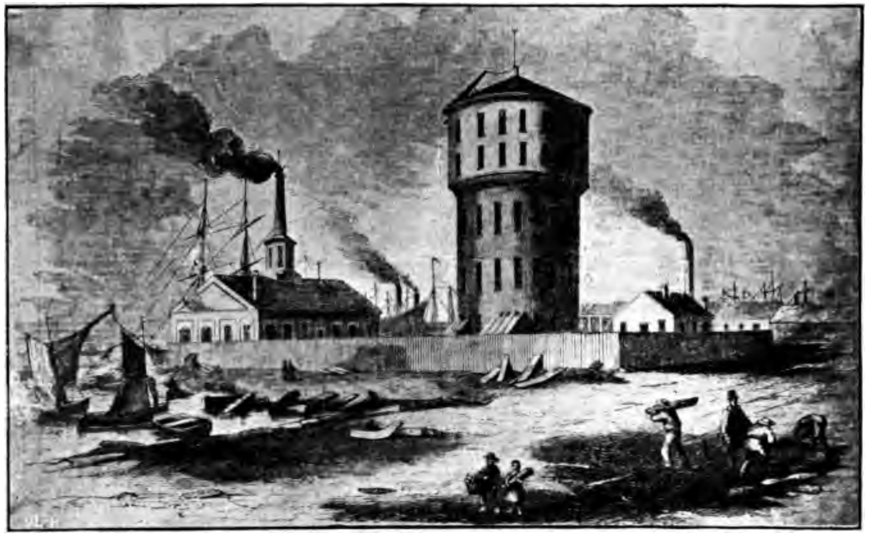
Gentlemen:—I have the honor to submit the Secretary's report for the year ending December 31st, 1900, and for the six months ending June 30th, 1901.

During the period covered by this report $200,000.00 of water bonds, at seven per cent, were refunded at three and one-half per cent; a system of water supply was installed in the Village of River Rouge, for which that village deposited with this Board the estimated cost, $36,200.00. As both of these items appear in the summary of receipts and disbursements, the totals are consequently greater than they ordinarily would be. The total of receipts is further augmented by the payment from the City of Detroit, in the month of January, 1900, the sum of sixty-six thousand two hundred and sixty-nine dollars and fifty-five cents, which was withheld by the City Controller during the previous year, pending litigation.

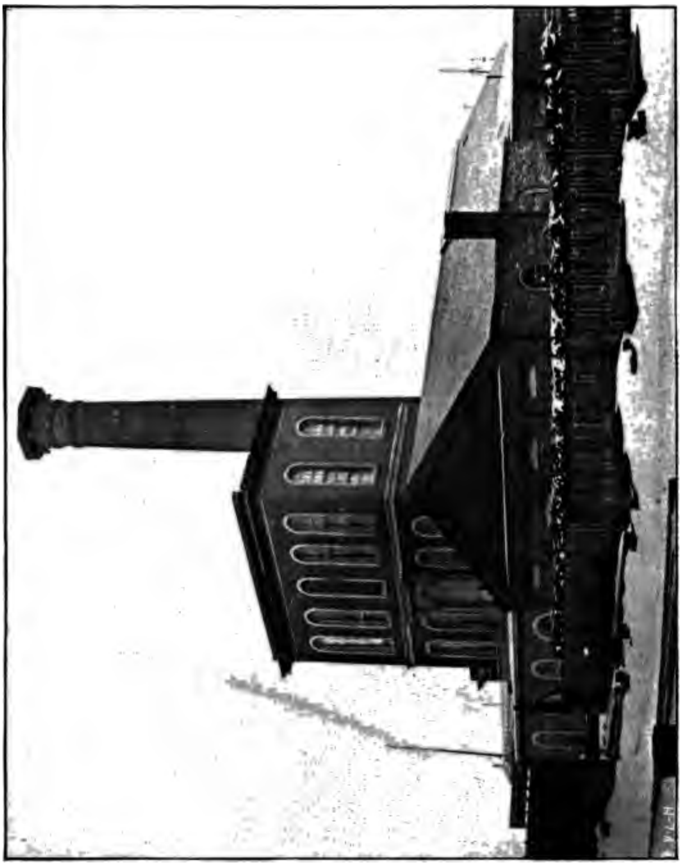
The following is a detailed statement of the receipts and disbursements:

Receipts.

	Year ending December 31, 1900.	Six months ending June 30, 1901.	Total.
Water Rates Account.—			
Rates received	$309,385 22	$164,616 76	
Percentage Account.—			
From delinquents	5,005 27	2,642 45	
For shutting off..................	448 50	235 20	
Plumbers License Account.—			
Received for licenses............	648 25	446 25	
Service Connection Account.—			
Service connections	3,751 75	1,859 25	
Labor and materials.............	139 51	39 38	
City of Detroit Account.—			
General tax levy.................	140,272 12	9,727 88	



1848 TO 1858.



For Construction—	Year ending December 31, 1900.	Six months ending June 30, 1901.	Total.
Service cocks	$ 69 47		
Legal services	372 05		
Advertising	221 10	$ 21 37	
Forge and fixtures	26 50	8 80	
	$ 79,034 20		
*Less amount furnished and charged to River Rouge	1,934 12		
	$ 77,100 08	$ 16,935 72	$ 94,035 80
Meter Account—			
Superintendent and labor	4,279 68	$ 2,089 77	
Meters	1,803 10	1,621 86	
Specials and fittings	108 99	47 77	
Materials, solder, etc	26 16	1 90	
Lumber	122 77	20 95	
Horseshoeing	18 50	11 00	
Horse board	180 00	90 00	
Tools	8 39	12 69	
Street car tickets	7 50	7 50	
Printing and stationery	5 05	4 50	
Packing	12 69	5 64	
Horse and wagon repairs	2 55	2 10	
Repairing tools	5 30	23 83	
Gasoline, etc.	5 29	1 94	
Bicycle and repairs	36 25	4 35	
Telephone	46 39	27 03	
Pump	6 00		
Meter well covers	9 11		
Miscellaneous	22 42	21 54	
	$ 6,706 14		
*Less amount furnished and charged to River Rouge	7 63		
	$ 6,698 51	$ 3,994 37	$ 10,692 88
Engineering Account—			
Civil engineer and assistants	$ 8,983 81	$ 4,408 43	
Instruments	175 59		
Tracing cloth, etc	117 24	109 36	
Books, maps and stationery	93 81	61 96	
Miscellaneous	38 90	38 76	
Street car tickets and postage	81 00	44 00	
Express and freight	5 14	5 96	

	Year ending December 31, 1900.	Six months ending June 30, 1901.	Total.
Telephone	$ 46 00	$ 39 03	
Book case and furniture	16 57	39 86	
Material general survey	55 44	27 16	
Expenses survey to Wayne	16 00		
	$ 9,629 50		
*Less amount furnished and charged to River Rouge	338 28		
	$ 9,291 22	$ 4,774 52	$ 14,065 74
Pumping Works Construction Account—			
Labor	$ 2,718 33	$ 2,799 73	
Machine materials	566 08	96 85	
Repairing roof and cornice	208 06	18 20	
Telephone	47 32	32 50	
Telegrams	1 73		
Lead pipe	31 90		
Engineers' expenses tour of inspection	218 85		
New boilers	4,599 41		
Repairing intake pipe	2,573 00		
Covering boilers	231 11		
Sounding for inlet	50 86		
Connecting up new boilers	2,398 50		
Angle iron and steel	59 68	516 52	
Lettering, glazing paint, etc	118 26	18 45	
Harness repairs and shoeing	7 85	4 00	
Inspecting and testing new boilers	250 00		
Repairs to dock	363 26		
Stone cutting and labor on conduit	32 01		
Electric wiring, etc	7 66	2 75	
Closet fixtures and sink	79 17		
Nails, tools, etc	56 40	95 17	
Ropes, blocks and rollers	45 43	116 09	
Roofing felt and paper	16 30	5 00	
Brick, cement, sand, etc	106 88	2,031 52	
Labor	6,729 02	10,179 04	
Lumber	613 84	1,350 37	
Advertising and printing	178 62	51 02	
Pipe and special castings	3,683 97	673 46	
Double faced gates	3,696 00	8,454 00	
Lowering pipe and valves	54 75	30 00	
Altering patterns	17 99		
Tie rods for engine bed		910 00	

	Year ending December 31, 1900	Six months ending June 30, 1901.	Total.
New gallery		$ 8,249 10	
Car tickets		40 00	
Electric candles		27 60	
Steam pump and divers		490 90	
Pile driving, etc		80 00	
Plastering well		26 75	
Twine, packing oakum, etc		14 74	
Paint and lead		2 04	
Traveling crane		2,240 00	
Cartage		9 00	
Pumping Works Construction, new building—			
Foundation contract, on account	$ 16,750 00	8,879 00	
Architects, on account	500 00	1,300 00	
	$ 47,012 24	$ 48,743 80	95,756 04
Horse Expense Account (Iron Pipe Construction)—			
Horse shoeing	231 78	101 15	
Bedding	40 00	5 00	
Drugs and veterinary services	92 16	5 41	
Feed, oats and hay	501 00	343 68	
Barn tools, etc	7 73	2 10	
	$ 872 67	$ 457 34	$ 1,330 01
Village of River Rouge Construction—			
Freight and Telegrams	10 31		
Car fare	10 00		
Printing	9 00		
Pig lead	1,613 00		
Pay rolls	6,445 41		
Meter	400 00		
Ball joints	120 00		
Specials, castings, hydrants and automatic gate	1,664 33		
Hardware, tools, etc	8 03		
Iron pipe	13,801 49		
Laying main across River Rouge	1,685 00		
License for Carroll Patent	175 00		
Teaming	624 04		
Brick, sand and cement	101 73		
Coal	13 95		
Packing	21 99		
Miscellaneous	8 14		
Material and labor furnished by iron pipe department	1,934 12		

	Year ending December 31, 1900.	Six months ending June 30, 1901.	Total.
Material and labor furnished by engineering department	$ 338 28		
Material and labor furnished by office department	333 34		
Service cocks	46 00		
Labor furnished by meter dept..	7 63		
	$ 29,370 79		$ 29,370 79
Total Construction...........	$170,345 51	$74,905 75	$245,251 26
Refund to Village of River Rouge excess of deposit over cost.....	6,833 21		6,833 21
Use of pipe for K. of P. encampment	228 90		228 90

OPERATION AND MAINTENANCE.

Pumping Water Account—			
Engineers, firemen, etc...........	$ 21,218 53	$ 10,916 10	
Coal	25,710 51	7,043 00	
Unloading coal	2,485 33	955 69	
Boiler and machine repairs......	224 28	1,573 13	
Engine oil	442 94	227 71	
Wash and packing rags..........	341 32	151 88	
Small supplies, soap, brooms, etc.	47 57	45 83	
Boiler and engine supplies......	301 23	58 10	
Telephone	9 05		
Electric light supplies...........	79 30	1 20	
Repairing coal car..............	45 52		
Ice	28 00		
Hose	16 74		
Stationery and printing..........	13 55	4 00	
Express	1 41		
Kerosene and gasoline...........	12 91	24 32	
Horseshoeing	7 00	4 00	
Paint, etc.	11 92	16 96	
Boiler inspection	37 50	36 00	
Hay.	30 35		
Insurance on boilers.............	290 00		
	$ 51,354 96	$ 21,057 92	$ 72,412 88
Office Account—			
Manager, secretary and clerks, etc.	$ 23,351 43	$ 10,614 74	
Watchmen and janitors.........	1,887 00	964 00	

	Year ending December 31, 1900.	Six months ending June 30, 1901.	Total.
Carpenter and general work	$ 1,621 50	$ 791 25	
Books, printing, stationery and binding	902 12	728 40	
Rubber stamps	12 10	4 45	
Miscellaneous supplies and expense	104 17	145 38	
Postage	148 85	86 93	
Telephones	280 52	116 86	
Advertisements and papers	148 34	31 04	
Premium on guarantee bonds	71 65		
Ice	54 36	20 45	
Horse expense	181 00	90 00	
Cleaning building	135 00	60 00	
Towels and supplies	78 00	39 00	
Horseshoeing	24 50	16 50	
Express and freight	91		
Street car tickets	22 50	10 00	
Safety deposit rent	10 00		
Disinfectants	12 50	6 00	
Harness repairs	1 40	3 40	
Gas and electric power	9 19	4 88	
Printing annual report	218 00		
Half-tones for annual reports		168 50	
Rebate on water tax	9 06		
Telegrams	4 02	19 63	
	$ 29,283 12		
Less amount charged to River Rouge	333 34		
	$ 28,954 78	$ 13,921 41	$ 42,876 19
Inspection Account—			
Inspectors and clerk	$ 6,335 80	$ 3,216 68	
Street car tickets	225 00	105 00	
Stationery and books	30 25	11 40	
Express		1 40	
Electric lamp supplies	10 16	13 80	
	$ 6,601 21	$ 3,348 28	$ 9,949 49
Plumbers' License Account—			
Printing	6 00	8 00	14 00
Repairing Leaks Account—			
Supt., clerks, watchmen and labor	$ 12,634 84	$ 7,223 55	
Repairing pavements and lawns	55 23	56 71	
Care of horses	165 00	90 00	

	Year ending December 31, 1900.	Six months ending June 30, 1901.	Total.
Wagon and harness supplies		$ 3 25	
Sundries	$ 11 10	11 98	
Horseshoeing	15 00	7 00	
Lumber		7 48	
Cartage	6 50		
Telephone	15 00	12 00	
Rubber boots	12 48	11 60	
Tools.	1 42	2 25	
Car fare	5 00	15 00	
Oil		3 33	
	$ 12,921 57	$ 7,444 15	$ 20,365 72
Meter Repairs and Expense Account—			
Labor	$ 1,090 25	$ 549 47	
Fittings	413 28	98 96	
Stationery	12 00		
Freight	3 78		
	$ 1,519 31	$ 648 43	$ 2,167 74
Service Connection Account—			
Labor	$ 7,975 02	$ 4,560 09	
Service cocks, sleeves and valves.	2,055 51	336 00	
Car fare	260 00	115 00	
Telephone	6 00		
Tools	78 30		
Stationery, printing, etc.	40 51	33 25	
Miscellaneous	23 97	9 73	
Packing	6 13		
	$ 10,445 44		
Less amount charged to River Rouge	46 00		
	$ 10,399 44	$ 5,054 07	$ 15,453 51
Horse Expense Account (Service Connections and Repairing Leaks).—			
Hay, oats, bran and corn	464 61	343 60	
Shoeing	146 85	100 41	
Bedding	30 00	25 00	
Veterinary services and drugs		8 00	
	$ 641 46	$ 477 01	$ 1,118 47
Office Furniture and Fixtures Account—			
Repairs	42 06		
Electric fans, etc.	157 58	4 29	
Cuspidors		5 50	
	$ 199 64	$ 9 79	$ 209 43

	Year ending December 31, 1900.	Six months ending June 30, 1901.	Total.
Real Estate Revenue and Expense Account—			
Repairs	562 96	55 30	
Plumbing	29 63		
Insurance	120 61	344 46	
Paint and glass	61 73	35 40	
Lumber	189 31	106 96	
Legal services	200 00		
Fire alarm rental	20 00		
	$ 1,184 24	$ 542 12	$ 1,726 36
Horse and Wagon Account—			
Harnesses and wagon painting and repairs	320 68	185 15	
Horses purchased	825 00	100 00	
Forge equipment	33 50	2 50	
Wagon for blow off and night repairs	412 50		
	$ 1,591 68	$ 287 65	$ 1,879 33
Percentage Account—			
Labor	$ 5,443 15	$ 2,799 99	$ 8,243 14
Hurlbut Fund Account—			
Labor	$ 4,874 60	$ 740 25	
Library	295 98	5 25	
Tools and repairs	222 21	67 88	
Librarians	1,155 00	315 00	
Repairing water clock	156 94		
Express charges	1 50		
Paints, oils, etc	66 42	9 63	
Miscellaneous	15 11	3 60	
Lumber	26 40		
Flower pots and baskets	31 77		
Sprinkling wagon	345 00		
Plants and seeds	36 43	2 14	
Horseshoeing and feed	38 20	60 80	
Subscription to papers and books and stationery	44 60		
	$ 7,310 16	$ 1,204 55	$ 8,514 71
Interest account—			
Interest and bonds paid	$ 60,807 00	$ 29,945 00	
Advertising and printing of bonds	683 95		
	$ 61,490 95	$ 29,945 00	$ 91,435 95
Bonded Indebtedness Account—			
Water bonds paid	$200,000 00		

RECAPITULATION OF EXPENDITURES FOR CONSTRUCTION AND OPERATION AND MAINTENANCE.

For Construction—	Year ending December 31, 1900.	Six months ending June 30, 1901.	Total.
Extension account	$ 77,100 08	$ 16,935 72	$ 94,035 80
Meter account	6,698 51	3,994 37	10,692 88
Engineering account	9,291 22	4,774 52	14,065 74
Pumping works account	47,012 24	48,743 80	95,756 04
Horse expense account	872 67	457 34	1,330 01
Village of River Rouge	29,370 79		29,370 79
	$170,345 51	$ 74,905 75	$245,251 26
Refund to the village of River Rouge	6,833 21		6,833 21
Use of pipe K. of P. encampment	228 90		228 90
For Operation and Maintenance—			
Pumping water account	$ 51,354 96	$ 21,057 92	$ 72 412 88
Office account	28,954 78	13,921 41	42,876 19
Inspection account	6,601 21	3,348 28	9,949 49
Plumbers' license account	6 00	8 00	14 00
Repairing leaks account	12,921 57	7,444 15	20,365 72
Meter repairs and expense account	1,519 31	648 43	2,167 74
Service connections	10,399 44	5,054 07	15,453 51
Horse expense, service cocks, repairing leaks	641 46	477 01	1,118 47
Office furniture and fixtures	199 64	9 79	209 43
Real estate revenue and expense	1,184 24	542 12	1,726 36
Horse and wagon account	1,591 68	287 65	1,879 33
Percentage account	5,443 15	2,799 99	8,243 14
	$120,817 44	$ 55,598 82	$176,416 26

GENERAL RECAPITULATION OF EXPENDITURES.

Total construction	$170,345 51	$ 74,905 75	$245,251 26
Refund to village of River Rouge	6,833 21		6,833 21
Total operation and maintenance	120,817 44	55,598 82	176,416 26
Total Hurlburt fund	7,310 16	1,204 55	8,514 71
Total interest account	61,490 95	29,945 00	91,435 95
Total bonded indebtedness	200,000 00		200,000 00
Total use of pipe K. of P. encampment	228 90		228 90
	$567,026 17	$161,654 12	$728,680 29

The total receipts of the receiving clerk from January 1st, 1900, to January 1st, 1901, were as follows:

January	$136,459 67	
February	225,516 65	
March	11,104 81	
April	53,707 24	
May	8,717 47	
June	52,267 25	
July	82,645 19	
August	62,882 09	
September	18,175 58	
October	69,953 82	
November	11,849 95	
December	14,157 71	
	$747,437 43	
Cash on hand January 1, 1900	2,881 64	
		$750,319 07
From January 1, 1901, to July 1, 1901:		
January	$ 71,313 45	
February	10,746 01	
March	12,217 68	
April	67,876 52	
May	11,065 65	
June	18,081 32	
	$191,300 63	
Cash on hand January 1, 1901	2,910 17	
		$194,210 80
With bank deposits as follows:		
January, 1900	$133,992 62	
February	229,132 60	
March	9,708 90	
April	51,597 27	
May	12,302 42	
June	50,859 79	
July	80,159 59	
August	67,142 97	
September	15,616 03	
October	69,242 66	
November	15,036 32	
December	12,617 73	
	$747,408 90	
Cash on hand January 1, 1901	2,910 17	
		$750,319 07

January, 1901	$ 69,080 91	
February	14,492 08	
March	10,387 80	
April	65,078 64	
May	15,691 88	
June	17,093 98	
	$191,825 29	
Cash on hand, July 1, 1901	2,385 51	$194,210 80

Cash Statement for the Year Ending December 31, 1900.

		Dr.	
Cash on hand December 31, 1899		$ 2,881 64	
Cash in Bank—			
General fund account		10,047 89	
Sinking fund account		42,734 16	
Hurlburt fund account		26 19	
Secretary fund account		1,000 00	
		$ 56,689 88	
Total receipts		745,437 43	
			$802,127 31
		Cr.	
Cash on hand December 31, 1900		$ 2,910 17	
Cash in Bank—			
General fund acct	$124,561 71		
Outstanding checks	10 20		
	124,551 51		
Sinking fund account	106,581 33		
Hurlbut fund account	58 13		
Secretary fund account	1,000 00	$232,190 97	
		235,101 14	
Total disbursements		567,026 17	
			$802,127 31

Cash Statement for the Six Months ending June 30, 1901.

	Dr.	
Cash on hand, December 31, 1900	$ 2,910 17	
Cash in Bank—		
General fund account	124,551 51	
Sinking fund account	106,581 33	
Hurlbut fund account	58 13	
Secretary fund account	1,000 00	
	$235,101 14	
Total receipts	191,300 63	
		$426,401 77

	Cr.	
Cash on hand, June 30, 1901	$ 2,385 51	
Cash in Bank—		
General fund account	172,588 45	
Sinking fund account	87,510 32	
Hurlbut fund account	1,263 37	
Secretary fund account	1,000 00	
	$264,747 65	
Total disbursements	161,654 12	
		$426,401 77

THE AMERICAN EXCHANGE NATIONAL BANK.

Detroit, January 2, 1901.

Benj. F. Guiney, Secretary Board of Water Commissioners of the City of Detroit:

Dear Sir—This is to certify that the amounts of balances in this bank to the credit of the Board of Water Commissioners of the City of Detroit at the close of business December 31, 1900, were as follows:

General account	$124,561.71
Sinking fund	106,581.33
Hurlbut fund	58.13
Secretary fund	1,000.00

Yours truly,

HAMILTON DEY,
Cashier.

THE AMERICAN EXCHANGE NATIONAL BANK.

Detroit, Mich., July 1, 1901.

Benj. F. Guiney, Secretary Board of Water Commissioners of the City of Detroit:

Dear Sir—This is to certify that the amounts of balances in this bank to the credit of the Board of Water Commissioners of the City of Detroit at the close of business June 30, 1901, were as follows:

General account	$172,588.45
Sinking fund	87,510.32
Hurlbut fund	1,263.37
Secretary fund	1,000.00

Yours truly,

HAMILTON DEY,
Cashier.

The following table is the report of the assessment for the year commencing July 1, 1900.

ASSESSMENT 1900-1901.

Dist.	WARDS.	Families.			Increase.	Vacant Tenements.	Assessment.		
		Supplied.	Not Supplied.	Whole Number.			1900-1901.	Increase.	Transf'rd to Meter Rolls.
1	Ninth.......	5,856	13	5,869	183	135	$17,325 70	$4,040 10	$29 30
	Fifteenth...	1,979	5	1,984	*22	23	8,096 50	1,790 25	62 50
	Seventeenth	2,092	16	2,108	116	33	9,053 90	2,200 20	94 30
	Totals ...	9,927	34	9,961	277	191	34,476 10	8,030 55	186 10
2	Eleventh ...	3,890	8	3,898	31	101	13,359 30	2,757 75	86 70
	Thirteenth..	3,198	....	3,198	158	28	11,528 30	2,554 25	69 40
	Totals ...	7,088	8	7,096	189	129	24,887 60	5,312 00	156 10
3	First........	3,025	1	3,026	94	61	17,074 65	2,678 85	73 50
	Seventh	3,546	6	3,552	32	21	11,370 95	2,764 20	137 50
	Totals....	6,571	7	6,578	126	82	28,445 60	5,443 05	211 00
4	Third.......	3,730	2	3,732	94	34	12,672 00	2,675 10	92 20
	Fifth........	4,185	5	4,190	69	57	13,303 20	2,488 90	217 70
	Totals ...	7,915	7	7,922	163	91	25,975 20	5,164 00	309 90
5	Second	2,463	3	2,466	146	83	14,650 75	308 15	345 60
	Sixth........	4,099	4	4,103	96	76	15,997 55	2,528 95	12 00
	Totals ...	6,562	7	6,569	242	159	30,648 30	2,832 10	357 60
6	Tenth.......	4,714	1	4,715	189	44	17,874 70	4,135 15	58 00
	Fourteenth.	2,835	7	2,842	92	42	10,723 70	2,570 50	80 00
	Totals ...	7,549	8	7,557	281	86	28,598 40	6,705 65	138 00
7	Fourth......	3,496	5	3,501	*150	98	15,911 50	2,253 05	129 15
	Twelfth	3,734	7	3,741	66	89	13,875 80	3,290 50	70 30
	Totals ...	7,230	12	7,242	*84	187	29,787 30	5,543 55	199 45
8	Eighth......	3,913	3	3,916	141	44	15,987 90	3,398 30	56 74
	Sixteenth...	3,769	50	3,819	220	30	12,591 00	3,339 55	54 25
	Totals ...	7,682	53	7,735	361	74	28,578 90	6,737 85	110 99
	Aggregate	60,524	136	60,660	1,555	999	$231,397 40	$45,768 75	$1,669 14

* Decrease.

The following table is the report of the assessment for the year commencing July 1, 1901.

ASSESSMENT 1901-1902.

Dist.	WARDS.	FAMILIES.			Increase.	Vacant Tenements.	ASSESSMENT.		
		Supplied.	Not Supplied.	Whole Number.			1901-1902.	Increase.	Transf'rd to Meter Rolls.
1	Ninth.......	5,867	13	5,880	11	157	$17,641 75	$316 05	$118 55
	Fifteenth...	2,069	1	2,070	86	23	8,785 70	689 20	38 70
	Seventeenth	2,323	4	2,327	219	27	10,258 40	1,204 50	82 60
	Totals ...	10,259	18	10,277	316	207	36,685 85	2,209 75	239 85
2	Eleventh ...	4,002	8	4,010	112	5	13,631 00	271 70	173 60
	Thirteenth..	3,263	....	3,263	65	25	11,888 50	360 20	193 10
	Totals ...	7,265	8	7,273	177	30	25,519 50	631 90	366 70
3	First........	3,284	1	3,285	259	47	18,117 35	1,042 70	116 20
	Seventh	3,599	5	3,604	52	53	11,525 45	154 50	122 30
	Totals....	6,883	6	6,889	311	100	29,642 80	1,197 20	238 50
4	Third.......	3,827	4	3,831	99	41	13,129 20	457 20	168 00
	Fifth........	4,229	2	4,231	41	47	13,904 50	601 30	196 80
	Totals ...	8,056	6	8,062	140	88	27,033 70	1,058 50	364 80
5	Second	2,509	2	2,511	45	46	14,552 96	*97 79	288 90
	Sixth........	4,136	3	4,139	36	60	16,041 10	43 55	186 60
	Totals ...	6,645	5	6,650	81	106	30,594 06	*54 24	475 50
6	Tenth.......	4,812	1	4,813	98	33	18,414 20	539 50	227 80
	Fourteenth.	2,943	7	2,950	108	25	11,703 40	979 70	39 30
	Totals ...	7,755	8	7,768	206	58	30,117 60	1,519 20	267 10
7	Fourth......	3,584	6	3,590	89	78	16,512 50	601 00	180 90
	Twelfth	3.850	7	3,857	116	68	14,381 60	505 80	205 50
	Totals ...	7,434	13	7,447	205	146	30,894 10	1,106 80	386 40
8	Eighth......	4,023	3	4,026	110	35	16,713 20	725 30	235 00
	Sixteenth...	3,959	35	3,994	175	20	14,178 90	1,587 90	130 00
	Totals ...	7,982	38	8,020	285	55	30,892 10	2,313 20	365 00
	Aggregate	62,279	102	62,381	1,721	790	$241,379 71	$9.982 31	$2,703 85

* Decrease.

As shown in this table, July 1, 1901, there were 62,279 families in the City of Detroit. Using the average per family obtained as in previous years, 5.04, the population of the city at that time was 313,886, an increase over July 1, 1899, of 10,086.

The average used was obtained by taking the population as shown by the United States Census of 1860-70-80-90, and 1900, and dividing by the number of families on Assessors' books for those years, as follows:

Years.	Population per census.	No. of families assessed.	Average.
1860	45,619	8,973	5.08
1870	79,757	14,717	5.42
1880	116,340	22,423	5.18
1890	205,876	42,059	4.80
1900	285,704	60,524	4.72

Making the general average 5.04.

The following table shows the receipts for water rates during the year, arranged by districts, and giving the amount collected upon each annual assessment:

RECEIPTS OF WATER RATES BY DISTRICTS.

From January 1st, 1900 to December 31st, 1900.

YEARS.	1st District Wards 9, 15 and 17.	2d District, Wards 11 and 13.	3d District, Wards 1 and 7.	4th District, Wards 3 and 5.	5th District, Wards 2 and 6.	6th District, Wards 10 and 14.	7th District, Wards 4 and 12.	8th District, Wards 8 and 16.	Meters.	Total.
1892–93	....	....	....	....	....	$1 75	....	$1 25	....	$3 00
1893–94	$5 00	....	....	$1 25	....	3 40	....	....	....	9 65
1894–95	....	....	$7 50	5 00	$1 25	11 50	....	5 35	....	30 60
1895–96	11 75	....	....	2 50	2 50	4 00	....	....	....	20 75
1896–97	2 00	$9 75	3 50	2 50	11 75	3 00	....	....	....	32 50
1897–98	6 25	....	7 00	50	5 39	5 82	$4 37	4 75	....	34 08
1898–99	34 71	7 10	11 48	9 69	1,014 57	21 24	18 44	10 55	....	1,127 78
1899–00	13,725 66	9,836 93	11,737 02	10,471 55	14,664 55	11,523 11	12,632 50	11,340 58	....	95,931 90
1900–01	17,787 21	12,805 39	14,701 38	13,273 31	16,201 54	14,649 70	15,141 43	14,673 68	$92,961 32	212,194 96
Total..	$31,572 58	$22,659 17	$26,467 88	$23,766 30	$31,901 55	$26,223 52	$27,796 74	$26,036 16	$92,961 32	$309,385 22

From January 1st, 1901 to June 30th, 1901.

YEARS.	1st District Wards 9, 15 and 17.	2d District, Wards 11 and 13.	3d District, Wards 1 and 7.	4th District, Wards 3 and 5.	5th District, Wards 2 and 6.	6th District, Wards 10 and 14.	7th District, Wards 4 and 12.	8th District, Wards 8 and 16.	Meters.	Total.
1893–94	....	....	....	....	....	$1 25	....	....	....	$1 25
1894–95	....	....	....	....	....	1 25	....	....	....	1 25
1895–96	....	....	....	....	....	....	....	....	....	....
1896–97	....	....	....	....	....	....	....	....	....	....
1897–98	$1 13	....	....	....	....	....	....	....	....	1 13
1898–99	4 50	....	$1 00	$2 25	$3 10	50	$1 75	....	....	13 10
1899–00	8 39	$45 17	19 81	2 25	22 51	5 18	10 70	$5 49	....	119 50
1900–01	16,630 13	12,010 26	13,493 33	12,371 23	14,236 67	13,896 60	14,044 63	13,582 83	$54,214 85	164,480 53
Total..	$16,644 15	$12,055 43	$13,514 14	$12,375 73	$14,262 28	$13,904 78	$14,057 08	$13,588 32	$54,214 85	$164,616 76

The amount expended for the Pumping Works to July 1st, 1901, is as follows:

ITEMS.	Previously Expended.	July 1st, 1901.	Total.
Land	$38,331 44	....	$38,331 44
Force Mains	624,058 03	....	624,058 03
Inlet Pipe	97,303 40	$2,623 86	99,927 26
Dock, Basin and Canal	148,502 25	363 26	148,865 51
Conduits and Wells	81,461 70	39,203 43	120,665 13
Engine, Boiler and Coal Houses	217,800 41	27,429 00	245,229 41
Stand Pipe and Tower	31,574 16	....	31,574 16
Pump Wells	54,221 56	....	54,221 56
Engines	359,338 87	910 00	360,248 87
Boilers	88,272 25	7,479 02	95,751 27
Engineer's House	8,139 75	....	8,139 75
Sewers	6,666 25	....	6,666 25
Electric Light Plant	2,781 19	....	2,781 19
Grounds, Fences and Gateway	153,562 02	5,518 06	159,080 08
Inspection	3,061 22	....	3,061 22
Miscellaneous	15,912 34	1,740 31	17,652 65
Library, Greenhouse and Belvedere	34,589 55	....	34,589 55
New Gallery	....	8,249 10	8,249 10
Travelling Crane	....	2,240 00	2,240 00
Totals	$1,965,576 39	$95,756 04	$2,061,332 43

Water Works Bonds.

The following table shows the whole history of the bonded indebtedness of the Board, in which it will be seen that the total amount of bonds issued is $1,950,000, of which $917,000 have been redeemed, leaving outstanding $1,033,000.

The $100,000.00 seven per cent. bonds which matured September, 1899, and $100,000.00 seven per cent. bonds which matured February 1st, 1900, were on the latter date refunded at three and one-half per cent.

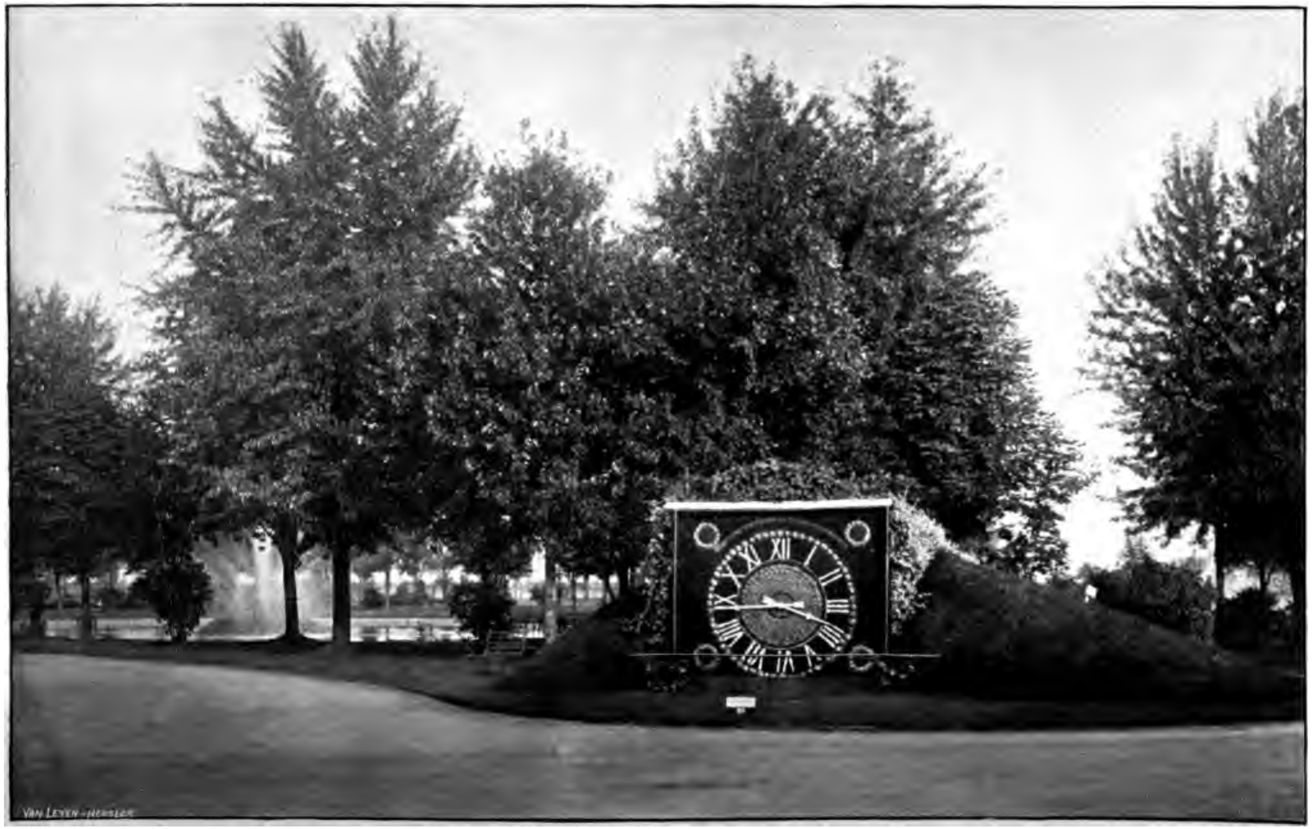
No. of Issue.	Act of	Issued.	Payable.	Amount.	Rate of Interest.	Redeemed or Refunded	Outstanding.
1st	1853	Aug. 1, 1853	Aug. 1, 1888	$100,000	7cts.	$100,000	....
"	"	" "	Aug. 1, 1878	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1873	50,000	7 "	50,000	....
2nd	1855	Aug. 1, 1855	Aug. 1, 1890	100,000	7 "	100,000	....
"	"	June 12, 1855	Aug. 1, 1885	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1880	50,000	7 "	50,000	....
3rd	1857	Aug. 1, 1858	Aug. 1, 1893	150,000	7 "	150,000	....
"	"	Aug. 1, 1867	Aug. 1, 1887	100,000	7 "	100,000	....
* 4th	1869	Feb. 1, 1870	Feb. 1, 1900	100,000	7 "	100,000	....
5th	"	Aug. 1, 1872	Aug. 1, 1902	50,000	7 "	....	50,000
6th	"	Aug. 1, 1873	Aug. 1, 1903	50,000	7 "	....	50,000
"	1873	Feb. 1, 1874	Feb. 1, 1904	50,000	7 "	9,000	41,000
7th	1869	Aug. 1, 1874	Aug. 1, 1904	50,000	7 "	6,000	44,000
"	1873	" "	" "	200,000	7 "	....	200,000
"	"	June 1, 1875	June 1, 1905	150,000	7 "	1,000	149,000
"	"	June 1, 1876	June 1, 1906	200,000	6 "	1,000	199,000
* "	"	Sept. 1, 1880	Sept. 1, 1899	100,000	4 "	100,000	....
"	"	April 1, 1881	April 1, 1897	100,000	4 "	100,000	....
"	"	Dec. 1, 1881	Dec. 1, 1896	50,000	4 "	50,000	....
"	"	Jan. 10, 1895	Jan. 10, 1925	100,000	4 "	....	100,000
*Refund	1869 1873	Feb. 1, 1900	Feb. 1, 1930	200.000	3½"	....	200,000
				$2,150,000		$1,117,000	$1,033,000

Estimated Valuation of the Works.

Real estate	$ 441,871 75
Buildings, docks, basins, conduits, engines, etc., at Pumping Station	1,795,569 68
Water pipe in use	3,789,656 94
Meters in use	99,077 75
Office furniture and fixtures	16,000 00
Tools and materials on hand:	
In office of Supt. of Construction	225 00
In office of Civil Engineer	20,992 42
In Inspection Department	81 00
In Meter Department	3,630 14
In Pumping Works Department	16,413 65
In Hurlbut Fund Department	1,873 70
At storage grounds	35,440 76
Total	$6,220,832 79

All of which is respectfully submitted:

BENJ. F. GUINEY,
Secretary.



FLORAL WATER CLOCK.

REPORT OF THE GENERAL MANAGER.

Detroit, July 1, 1901.

To the Board of Water Commissioners of the City of Detroit:

Gentlemen:—I respectfully submit a report of the general operations of the works for the year ending December 31, 1900, and of the first six months of the year 1901.

The change in the commencement of the year of the Board from January 1st to July 1st, to correspond with the fiscal year of the various other commissions and city officers, necessitates including in the reports of the heads of the several departments operations covering eighteen months.

The assessment rolls of water rates show a gain in assessments for the year to July 1, 1900, over the preceding year of $45,768.75; the gain July 1, 1901, over the year to July 1, 1900, was $9,982.31.

In June, 1900, the rates for unmetered water were increased about 20 per cent, to take effect July 1, 1900. Meter rates were adopted as follows: Quarterly rate, first 30,000 gallons, $1.75; all in excess of 30,000 gallons at two and one-quarter cents per 1,000 gallons; minimum rate, $1.75. This was, to a large extent, made necessary by the act providing for assessing abutting property for the cost of laying water mains, being declared invalid.

The increase of families to July 1, 1900, over the previous year was 1,555, and the increase to July 1, 1901, over the year 1900, was 1,721. A reference to the assessment table in the report of the Secretary, shows in detail the number of families assessed in each ward and district, vacant tenements, the number of families in the city unsupplied and increase of assessments.

The amount received for metered water for the eighteen months, from January 1, 1900, to July 1, 1901, was $148,163.16, of which amount the Village of Delray paid $6,390.36, the Village of Highland Park paid $837.72, and the Village of River Rouge paid $107.65.

The total number of gallons of water pumped for the year 1900 was 17,077,100,477, an increase over 1899 of 729,037,776 gallons. The amount pumped during the first six months of 1901 was 8,849,732,755, making a total pumpage for the eighteen months of 25,926,833,232 gallons, of which 159,766,816 gallons were supplied to the Village of Delray, 20,698,656 gallons to the Village of Highland Park, and 2,297,856 gallons to the Village of River Rouge. Meters are placed on the mains at the city line between these villages, and the city receives double the city rate for all water supplied.

The per capita daily consumption for 1900 was 153 gallons, an increase of six gallons over 1899. The per capita for 1897 was 125 gallons, for 1898 was 135 gallons, 147 for 1899, 153 for 1900, and 163 for the first six months of 1901. Since 1898 comparatively few meters have been placed, and I believe the increased per capita each year is largely due to this fact. The enormous waste in Detroit is apparent by comparison with the quantity of water consumed in the City of Milwaukee, the population of that city, as shown by the census of last year, being but 200 less than this city. Presumably the uses for water are the same in each city. Milwaukee has 68 per cent of taps metered; Detroit has 10 per cent. In 1900, the per capita in Milwaukee was 88 gallons; in Detroit it was 153 gallons; a difference of 42½ per cent.

At a meeting of the Engineers' Society, of London, Eng., held last spring, after an exhaustive discussion of the subject, the almost unanimous opinion prevailed that 50 gallons was a very generous per capita. This amount may not be sufficient for American cities, where different conditions prevail, but certainly 100 gallons should be a liberal consumption. The cost of fuel per million gallons pumped in Detroit last year was $1.48. It certainly is not "good business" to expend large sums of money to pump water to be wasted.

In considering the subject of waste, the matter of house to house inspection deserves consideration. During the last three years, on account of the inspectors' time being taken up with other work, it has been impossible to give proper attention to house inspections for leaks. While inspection of private premises causes annoyance and irritation to our citizens, it seems, at present, a necessity. Great objection is made to admitting strangers into premises, and although the inspectors are provided with proper credentials showing their authority, many complaints have been received that men, claiming to belong to the water department, have gained admission to premises only to attempt to sell filters, attachments, etc. It is not advisable here to enter more fully into the many objections to this system. This condition has a bearing on the meter question, as it could be remedied by the placing of meters on all premises supplied with fixtures. Leaky fixtures will soon be repaired when payment for the waste is required.

The Supreme Court of the State decided adverse to the Board in suit brought to compel the Park Commission to pay for water furnished them for park and boulevard purposes, holding that this Commission, being one of the departments of the city, could not collect for water used by other city departments. The decision further stated, however, that the Board was not compelled to furnish water for municipal purposes without payment therefor.

The Court also (June 5th, 1900), in the case of the Cook Farm Co. vs. the Board of Water Commissioners, held invalid the act providing for assessing abutting property for the cost of laying water mains. Pipe had been laid under this law, and assessments levied against abutting property for same, amounting to the sum of $67,694.75, of which the sum of $13,992.65 had been collected. This amount the Board returned to the City Treasurer, by whom it was refunded to the persons entitled thereto.

Storage Grounds.

By the opening of Orleans street through the grounds they have been divided into two separate yards. About six hundred feet of fencing is now being constructed, at an estimated cost of $325.00, for the proper protection of the property stored on the grounds.

I recommend that the east yard be used only for the storing of pipe and large castings. This would do away with the necessity for an extra watchman.

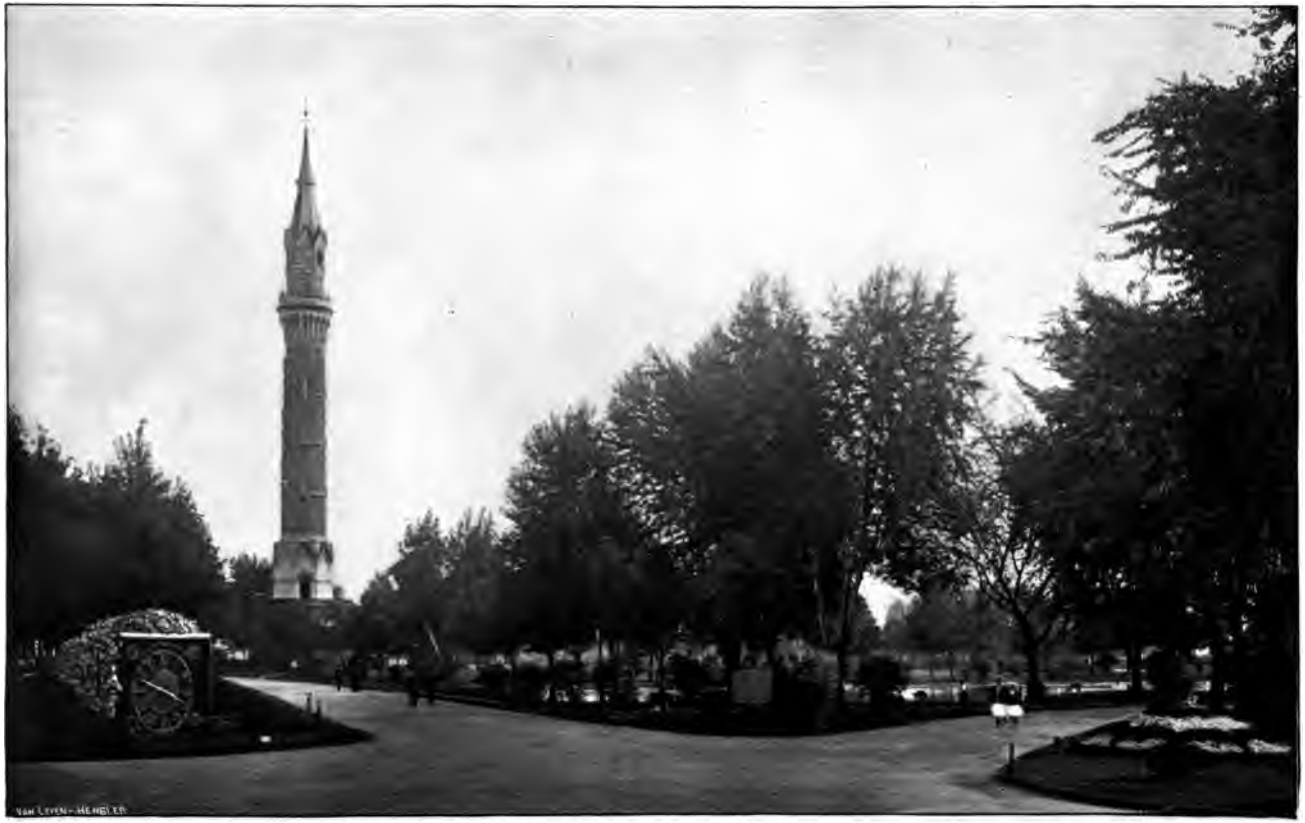
A pattern house, for the storage of patterns belonging to the Board, is nearing completion. These patterns are valued at $5,000.00, and are at present stored at various foundries about the city. The need of this building for their proper care was imperative.

A portion of the building has been arranged as a tool room, by means of which a more perfect system of checking the issue and return of tools can be carried out.

Pumping Works.

The foundation for the addition to the engine house has been completed, and contract for the superstructure, amounting to the sum of $69,021.00, has been made. This work is progressing rapidly. The roof is required to be in place by October 1st, 1901, and the entire work completed by December 1st, 1901.

A contract was made in September, 1900, with the Edward P. Allis Company, of Milwaukee, for furnishing and erecting two twenty-five million gallon triple expansion pumping engines complete, for the sum of $276,000.00. The



VIEWS IN WATERWORKS PARK

first engine will be shipped about January 1, 1902, and it is expected to be ready for operation about June 1, 1902. The second engine is to be delivered within six months from that date.

The four vertical safety water tube boilers, of 225 horse power capacity each, contracted for in 1899, were completed in the spring of 1900, and have been in service since that time, giving good satisfaction. The connecting steam pipes were covered with asbestos covering, at a cost of $220.00.

The old galleries in engine house were removed and new galleries, with crane track, were constructed on side and rear walls, at a cost of $8,159.00.

A 20-ton hand crane was erected at a cost of $2,390.00.

During a severe storm of August 20, 1900, the roof was badly damaged, and was repaired at a cost of $208.06.

The entire building, both inside and out, is badly in need of repainting, but would recommend that this work be not done until completion of the addition.

December 24th, 1900, shaft of Engine No. 2 broke. Fortunately, the old shaft taken from Engine No. 1 the previous year, had been put in condition for an emergency of this kind, and much delay was saved by this foresight. The wisdom of building the conduit, in 1899, connecting Engines Nos. 2 and 3, was apparent during this period.

A new conduit, with well, west of conduit No. 2, from the settling basin, to connect with the conduit system, has been completed, and conduit No. 2 is being rebuilt. Substantial concrete docks have been constructed at their intakes. Details of this work will be found in the report of the Civil Engineer.

Intake pipe No. 3 was found to be in bad condition, and repairs were made at a cost of $1,654.00.

The park grounds have been kept in first-class condition, the floral display attracting wide attention. A large amount of sodding and regrading has been done, especially covering the section of the park from the Engineer's residence to the river front. The foot and carriage bridges have been painted and repaired, and are in good condition. The water closets in the tower have been replaced by those of more modern pattern. This will permit the lavatories to be kept open during the winter, without danger of freezing, for the convenience of skaters.

The Hurlbut Memorial Library, which is also being operated as a branch of the Detroit Public Library, has become a great convenience to the people living in the eastern part of the city. Public Library books were circulated from there during 1900, as follows: January, 115; February, 204; March, 346; April, 484; May, 643; June, 503; July, 438; August, 383; September, 368; October, 491; November, 496; December, 529; during first six months of 1901, as follows: 'January, 775; February, 790; March, 830; April, 625; May, 462; June, 429.

Reference books were used in library as follows: 1900—January, 154; February, 220; March, 162; April, 310; May, 143; June, 127; July, 240; August, 295; September, 307; October, 487; November, 720; December 528; 1901—January, 640; February, 654; March, 596; April, 431; May, 392; June, 423.

The library is most frequented between the hours of 3 and 6, and 7 and 9 o'clock p. m., although there are many visitors during the entire time it is open.

The following table shows the quantity of water pumped each year, from 1852 to 1901:

Hurlbut Library and Belvedere.

YEARS.	FAMILIES SUPPLIED.	WATER PUMPED.	
		TOTAL QUANTITY.	PER FAMILY.
1852	......	235,840,275	......
1853	4,283	303,531,743	70,868
1854	4,619	376,265,126	81,460
1855	5,282	542,807,364	102,765
1856	5,706	692.124,305	121,297
1857	6,189	697,190,523	112,650
1858	6,474	718,091,207	110,919
1859	6,794	782,112,587	115,118
1860	6,750	870,036,451	125,185
1861	7,128	895,129,423	125,579
1862	7,275	994,945,329	136,762
1863	7,699	1,035,798,043	134,534
1864	7,993	1,019,390,256	127,410
1865	8,351	1,040,514,887	125,675
1866	9,089	1,196,317,922	131,622
1867	10,242	1,425,535,230	139,186
1868	11,544	1,666,545,125	144,364
1869	12,774	1,946,810,325	152,400
1870	13,722	1,866,060,068	136,000
1871	14,896	2,300,150,605	154,414
1872	16,035	2,782,292,578	173,513
1873	17,019	3,198,393,948	187,930
1874	18,853	3,289,872,635	174,511
1875	19,606	4,207,454,260	214,600
1876	20,102	4,065,134,470	200,225
1877	20,345	4,213,239,790	207,090
1878	20,603	4,345,743,330	210,927
1879	21,341	5,129,599,110	240,348
1880	22,465	5,552,965,310	247,183
1881	23,749	6,543,127,968	279.722
1882	25,442	6,284,000,742	243,062
1883	27,415	7,379,327,788	269,170
1884	29,424	8,510,614,140	289,260
1885	30,533	9,970,829,580	326,886
1886	31,946	10,576,571,254	331,070
1887	34,486	13,168,859,808	381,860
1888	36,863	14,380,166,670	390,098
1889	39,158	12,875,334,453	328,880
1890	41,467	12,120,944,532	292,300
1891	43,933	12,057,261,236	274,470
1892	46,400	12,276,612,482	264,582
1893	49,817	13,877,977,208	278,579
1894	49,912	13,649,779,605	273,476
1895	51,426	14,698,451,954	285,818
1896	53,941	13,254,369,371	245,719
1897	54,945	12,928,821,326	235,305
1898	56,341	14,278,682,058	253,433
1899	58,931	16,348,062,701	277,410
1900	60,524	17,077,100,477	282,154

Pipeage System.

You are respectfully referred to the report of the Superintendent of Construction for details of the work done in this department during the eighteen months covered by this report.

The mains have been thoroughly flushed during this period, and dead ends blown off at least twice each month. I recommend that dead ends be cured wherever possible. Gates have been systematically examined and repairs made when necessary.

The total mileage of the distribution system July 1, 1901, was 571 miles and 2,792 feet, of which 10 miles and 5,267 feet were laid from January 1, 1900, to July 1, 1901; 4 miles and 2,575 feet were laid in the city, 1,557 feet in Delray, 6 miles and 820 feet in the Village of River Rouge, and 315 feet in the Township of Greenfield. The entire cost of laying pipe in these villages was paid by said villages, the Board receiving therefor the sum of $30,807.12, of which the Village of River Rouge paid the sum of $29,370.79, the Village of Delray paid the sum of $1,182.17, and the sum of $254.16 was paid for pipe in Greenfield.

Two serious breaks occurred in the system during 1900, one, September 12th, on the 42-inch line, at the corner of Mt. Elliott and Congress; and the other, November 1st, on the 30-inch line at the corner of Buchanan and Twenty-seventh streets. The employes in the iron pipe department are entitled to much credit for the able manner in which these breaks were handled.

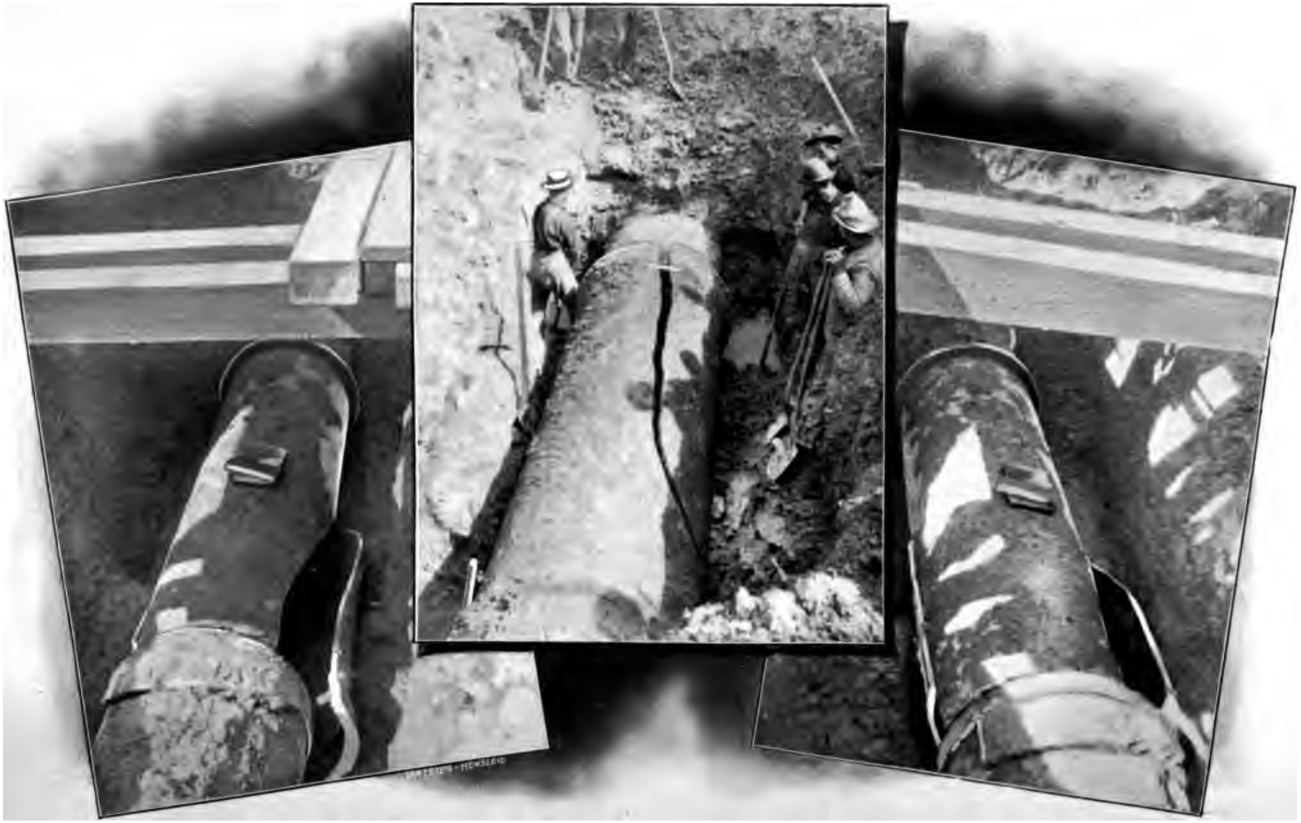
Data Detroit Water Works, 1900.

System of water works: Direct pressure. No reservoir.

Source of supply: Detroit river.

Number of pumping stations: One.

Type of pumps: One 30,000,000 Comp. Beam Two 24,000,000 Comp. Beam. One 24,000,000 triple Allis. Total capacity, daily, 102,000,000 gallons.



Break in Forty-two-Inch Pipe.

Area of city: 29 square miles.

Population: Census 1900, 285,704. Supplied (estimated city and suburbs), 306,055.

Pumpage 1900: 17,077,477,000 gallons.

Consumption, gallons, unmetered: 13,253,847,349.

Consumption, gallons, metered: 3,823,253,128.

Average daily consumption: 46,786,576 gallons.

Consumption per capita: 153 gallons.

Revenue unmetered water: $216,423.90.

Revenue metered water: $92,961.32.

Revenue per 1,000 gallons metered water: $.024.

Revenue per 1,000 gallons unmetered water: $.016.

Number of meters (July 1, 1901): 5,635.

Kind of coal used: Bituminous coal, run of mine.

Price per ton: $3.29 in sheds.

Total cost of fuel consumed (including heat and light of library and greenhouses) $25,398.50.

Average head against pumps in feet: 115.

Number of miles mains: 570.

Number fire hydrants: 3,332.

Service taps (July 1, 1901): 57,234.

Gates: 6,875.

City Water Supply.

The purity of the water supply is of so much importance to the public that the following extract from the report of the Board of Health for the fiscal year 1900, together with its report of examination of the supply for the month of June, 1901, is submitted:

"For nearly four years past systematic chemical and bacteriological examinations of our water supply have been made each month, the results of which appear in the annual reports of this department. The variations in the samples analyzed during the past year have not been greater than in previous years, and in no case were results obtained which would warrant an unfavorable report. I do not believe that any typhoid fever has come from our water supply, during the last few years at least. Our death rate from that disease has certainly been remarkably low in comparison with that of other American cities. For the years ending in June, 1898, 1899 and 1900, Detroit's typhoid fever death rate per 10,000 population was 1.60, 1.83 and 1.70 respectively.

"Examination of Detroit's water supply for the month of June, 1901:

Appearance clear.	Parts per million.
Total solids	104.6
Volatile matter	35.6
Non-volatile matter	69.0
Free ammonia	.008
Albuminoid ammonia	.068
Nitrogen as nitrates	.099
Nitrogen as nitrites	.000
Chlorine	2.85
Oxygen absorbed in 15 minutes	.38
Oxygen absorbed in 4 hours	.68
Bacteria per cubic centimeter June 7th, 1901	47.
Bacteria per cubic centimeter June 8th, 1901	29.
Bacteria per cubic centimeter June 10th, 1901	110.
Bacteria per cubic centimeter June 11th, 1901	88.

Growth in 2 per cent. carbo gelatin: None.

Conclusion: Water is in very good condition, indeed."

All of which is respectfully submitted,

H. S. STARKEY,
General Manager.

REPORT OF THE CIVIL ENGINEER.

Detroit, Mich., Aug. 1, 1901.

To the Honorable the Board of Water Commissioners of the City of Detroit:

Gentlemen—As required by the regulations, your Civil Engineer presents the following report, covering the operations of the Engineering Department for the period of eighteen months from Jan. 1, 1900, to June 30, 1901:

Distribution System.

The division of the distribution system into upper and lower pressure districts to correspond with the elevation of the ground, has been accomplished, as directed by the Board. The dividing line crosses Woodward avenue at the intersection of Canfield avenue and follows approximately a contour line 50 feet above the mean level of Detroit River, dropping a little below in the northwestern, and keeping a little above in the northeastern portion of the city, in order to compensate in a measure for the difference in frictional loss due to the varying distance from the pumping station. The upper system contains approximately 116½ miles, and the lower 453½ miles of cast-iron distributing pipe, making a total of 570 miles in service (Jan. 1, 1901).

The division required the actual separation of the two systems at 47 points and supplementary work at 27 others, making a total of 74 street intersections at which alterations were necessary. This work was commenced Sept. 13 and completed Dec. 6, 1900.

ressure system is now temporarily supplied ack avenue 42-inch main, pending the com- e high service main from the pumping station ersection of Collins and Superior streets, upon which work has been begun, and the erection of two 25-million Allis pumps, already contracted for. This is the most radical change and the largest improvement undertaken since the removal of the works from the foot of Orleans street to the present location in 1874-81, and the final abandonment of the reservoir in 1886.

Flushing has been carried on quite extensively from time to time, but not as thoroughly as during the two previous years. The large mains were found generally in better condition than one year ago, but the small pipes contain considerable deposit and are often quite foul. No record has been kept of the quantity of water used or mud removed. In the future general flushings, to be most effective, should be conducted in May and June of each year. The pipes will thus be cleaned after the period of roily water which occurs in the spring, and before the period of excessively hot weather when a majority of bad water complaints are received. Moreover, the full capacity of the mains will thus be made available during the period of hot weather consumption just when most needed to reduce the frictional loss.

The fire protection facilities in the northeastern manufacturing belt will be materially improved when the line of 8-inch and 10-inch pipe ordered laid on Harper avenue from St. Aubin to Russell street shall have been completed.

The Village of River Rouge, lying southwest of the Village of Delray, and having an estimated population of 1,700, was granted permission by the Board to lay a distribution system, to be supplied with water from the City of Detroit in accordance with the recommendations, plans and estimates of the Engineering Department in May, 1900. The work, including $5\frac{7}{10}$ miles of 8-inch, 6-inch and 4-inch pipe, was successfully executed by the superintendent of

MILLION GALLONS PER DAY

construction, James H. Barry,[*] at a cost considerably below the estimate, all being completed and meters set on Sept. 5, 1900. The supply is taken from the Delray system, and passes through two 4-inch Thomson meters and a submerged 8-inch line with flexible joints laid under the River Rouge. An 8-inch valve of special design, which opens automatically when the loss of head through the meters exceeds 8 lbs. and closes again when the loss is reduced to 5 lbs., is set in the main line to save the meters from damage and prevent the possibility of short supply during fires. Fire pressure is obtained from the Delray fire pump.

Population and Consumption.

The daily consumption of water, range of temperature and rainfall is graphically shown on plate No. 1.

The total quantity of water pumped is given in detail as follows:

	1900 12 MONTHS, January to December inclusive.	1901 6 MONTHS, January to June inclusive.
City of Detroit, unmetered	13,253.783,749	6.786,110.701
City of Detroit, metered	3,712,231 996	1.993.148 476
Village of Delray, by meter	95 719,765	63 063.442
Village of River Rouge, by meter	[†]556,063	1,520,384
Village of Highland Park, by meter	14,808 904	5,889.752
Totals, gallons	17,077,100,477	8,849,732,755

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[*] Died February 16th, 1901.

[†] Four months only, beginning September 5th.

The population statistics are as follows:

CITY OF DETROIT.

	Total population, U. S. census 1900	285,704
	Total families in city, Water Works count, June 1900	60,601
	No. of persons per family—285,704÷60,601	4.715
	No. of families supplied outside city limits	259
	No. of families not supplied in city	136
	Net No. of families supplied	60,724
1900.	Est. No. actual consumers—60,724×4.715	286,317
	Total families in city, Water Works count, June, 1901	62,246
	No. families supplied outside city limits	287
	No. families in city not supplied	102
	Net No. families supplied	62,431
1901.	Est. No. actual consumers—62,431×4.715	294,362

VILLAGE OF DELRAY.

	Reported total population, U. S. census 1900	4,573
	Total families supplied, books of Village Clerk. June, 1900	493
1900.	Est. No. actual consumers—493×4.715	2,324
	Total No. families supplied, books Village Clerk, 1901	765
1901.	Est. No. actual consumers—765×4.715	3,607

The village plumber estimates that about one-quarter of the families still take water from wells which checks above figures very closely.

VILLAGE OF RIVER ROUGE.

	Population by U. S. census 1900	1,748
	Est. total population, Village Clerk, June, 1901	1.900
	Total No. families supplied, Village Clerk, June, 1901	175
1900.	Est. No. actual consumers	435
1901.	Est. No. actual consumers—175×4.715	825

VILLAGE OF HIGHLAND PARK.

Total population U. S. census 1900	427
Est. No. persons supplied, 1900, 73 taps	423
Est. No. persons supplied, 1901, 78 taps	452

From the foregoing data, the following table is prepared, giving the average daily and per capita consumption:

CITY.	TIME.	U. S. Census, 1900.	Total Population Supplied.	Average U. S. Gallons Daily.	Gallons Daily perConsumer.	REMARKS.
Detroit	12 months, 1900..	285,704	286,317	46,482,235	162.3	City.
	6 months, 1901...	....	294,362	48,504 195	164.7	
Delray.....................	12 months, 1900..	4,573	2,324	264,053	113.6	Sewers; manufactories; small houses.
	6 months, 1901...	....	3,607	353,141	97.9	
River Rouge...............	4 months, 1900*..	1,748	435	4,753	10.9	No sewers; no manufactories; small houses.
	6 months, 1901...	....	825	8,400	10.2	
Highland Park.............	12 months, 1900..	427	423	40,572	95.9	Sewers; modern houses and fixtures.
	6 months, 1901...	....	452	32,540	71.9	
Totals............ ...	12 months, 1900..	292,462	289,499	46.786,577	161.6	
	6 months, 1901...	....	299,246	48,893,551	163.4	

* 117 days only.

Pressures.

The hourly record of pressures taken at various engine houses throughout the city is one of the most important branches of work carried on by the Engineering Department. This is especially true since the division of the system into upper and lower pressure districts.

Several new gauges have been set and great care taken to have all gauges, including those at the pumping station, tested from time to time to insure accurate results. Table No. 1 gives the average daily water pumped for each month and shows the corresponding pressure and frictional loss occurring at each gauge point. It will be observed that since the division of the system the pressure in the upper district has been increased an average of nearly 3 lbs., varying from 1½ to 5 lbs. No complaints of short supply have been received from this district since the division was made. There is, however, a marked falling-off of pressure in the extreme western portion of the city, especially during periods of maximum consumption. To further study the needs of this district and the best methods of meeting them, Table No. 2 is given showing the conditions existing at periods of maximum and minimum consumption, and for the month of July, 1901. Attention is called to the last column in particular, which gives the frictional loss between the pumping station and the various gauge points, as observed on Monday, July 1, 1901, from 7 to 8 o'clock p. m.

During this hour the consumption was at the rate of 89,071,920 gallons per day, or about 83 per cent in excess of the average for the first six months of 1901. The effect, however, upon the frictional loss between the pumping station and the gauge in Engine House No. 15, at Hubbard and Fort streets, was an increase of 135 per cent from the yearly average of 13.58 lbs. to 32.84 lbs. With so much pressure consumed in friction it is not possible to supply water to the upper stories of buildings and factories in the extreme southwestern portion of the city, and numerous

For a closer examination, let the distance between the pumping station and Eng. No. 15 be divided into two sections as follows:

	FRICTIONAL LOSS OBSERVED.		
	Average Consumption, 48,893,551.	Maximum Consumption, 89,071,920.	Per cent. increase, 83 per cent.
Pumping Station to Water Office	8.37 lbs.	15.93 lbs.	92 per cent.
Water Office to Engine House No. 15	5.21 lbs.	16.91 lbs.	224 per cent.

From which it is seen that an increase of 83 per cent in the total quantity of water pumped caused an increase of 92 per cent in the frictional loss between the pumping station and the water office, and 224 per cent between the water office and Hubbard avenue, which demonstrates that additional carrying capacity is required in the latter section, and that the full capacity of the 24-inch line laid out Michigan avenue in 1893 has already been reached. It is therefore recommended that a new main be laid on a route to be selected from Sixth and Congress to Fort and Vinewood avenue, a distance of about 9,400 feet. For this line a pipe 24 inches in diameter would meet the present requirements and give relief for at least a few years. It is believed, however, that the prospective future growth would justify the Board in laying a pipe not less than 36 inches in diameter, and this size is recommended. The total cost, subject to market prices, is estimated at $75,000. Until such a pipe is laid, complaints of short supply will continue to be received from the western district during periods of greatest demand.

Conduits and Proposed Tunnel.

The urgent need of additional capacity in the conduits leading from the settling basin to the pumps was demonstrated in the fall of 1900, when it was found impossible to

AY	MINIMUM SUMMER DAY May 26, 1901 GALLONS 36,074,340 Sunday.				MINIMUM WINTER DAY March 31, 1901 GALLONS 39,613,280 Sunday,				MONTH OF JULY, 1901 GALLONS Daily Average 55,025,594				MAXIMUM H July 1, GALL 3,711 D'y Rate 89 7 to 8 P.M.	
ic. ss s.	Pressure, lbs.			Fric. Loss lbs.	Pressure, lbs.			Fric. Loss lbs.	Pressure, lbs.			Fric. Loss lbs.	Max. Pres-sure	Pre sur
	High	Low	Av'ge		High	Low	Av'ge		High	Low	Av'ge		7-8 P. M.	Av'
...	50	45	47.38	......	50	45	48.15	......	60	45	53 06	......	59	57.
.60	....	....	......	......	....	....	......	......	42	29	35.80	2.64	40	39.
.23	35	29	31.88	1.31	35	31	33.04	0.92	40	28	34.80	4.07	37	36.
.69	31	26	29.37	3.94	31	28	29.54	4.54	35	25	30.11	8 88	32	31.
.58	33	29	30.75	4.08	34	30	30.96	4.64	35	27	31.04	9.47	30	30.
.82	28	27	27.63	5.39	28	27	27.63	6.16	31	'25	27.64	11.06	28	27.
.96	33	29	31.25	5.42	34	30	31.67	5.77	35	27	31.18	11.17	31	30.
.32	30	27	28.75	5.19	33	28	30.67	4.04	33	26	29.12	10.50	28	28.
.97	31	24	28.92	5.88	30	27	28.96	6.61	33	24	28.42	12 06	27	26.
.96	30	28	28.67	8.25	30	27	28 37	9.32	32	21	26.73	15.87	20	20.
.59	27	25	25.54	7.63	28	24	25 50	8.44	30	16	25.67	13.18	16	16.
.49	29	24	26.54	6.43	30	25	26 92	6.82	30	20	25.37	13.28	20	19.
.27	30	27	28.67	8.76	30	26	28.08	10.12	32	15	25.61	17.50	15	15.
.96	30	28	28.88	5.79	31	27	28.71	6.73	31	16	26.02	14.33	18	17.
.34	30	26	28.37	7.13	30	25	27.13	9.14	31	16	24.88	16.30	16	16.
.41	28	22	25.08	1.41	29	23	25.75	1.51	35	22	29.19	2.98	32	30.
60	26	21	23.58	0 31	27	22	24.13	0 53	33	21	26.65	2.92	28	27.
.88	24	20	21.46	3.75	23	20	21.88	4.10	25	19	21.91	8.98	21	20.
.50	21	17	19.13	5.37	21	18	19.54	5.73	22	16	19.44	10.74	20	19.
.21	19	14	16.92	5.08	20	15	16.87	5.90	21	13	17.47	10.21	16	15.
.92	20	16	17.96	5.29	22	16	18.21	5.81	22	10	17.72	11.21	16	16.
.87	20	16	18.33	5.37	20	16	18.25	6.22	22	11	17.71	11.67	15	14.
.14	19	16	17.54	8 39	21	16	17.33	9 37	21	11	16.93	14 68	14	12.
.49	26	20	22.63	1.65	27	22	24.04	1.01	33	21	26.86	3.10	29	28.
.46	20	15	18.29	2.13	23	18	19.63	1.56	28	15	20.65	5.45	20	19.
.74	....	....	......	......	21	16	17.83	2.05	24	13	18.65	6.14	16	16.
.30	20	15	18.08	2 97	22	17	19.33	2 49	26	16	20.21	6.52	18	17.
.37	21	16	18.50	1 66	22	16	19.21	1.72	26	16	20.41	5.43	16	16.
.28	19	14	17.21	2.43	20	16	17.63	2.88	25	15	18.96	6.46	19	17.

supply the pumps with sufficient water and at the same time make the necessary repairs and alterations required by the enlargement of the station. A circular, three-ring brick conduit, 5 feet 2 inches inside diameter, laid in Portland cement mortar, has therefore been constructed from a new concrete dock at the settling basin to a junction with the old 5-foot conduit supplying Engine No. 4. The center line of new conduit is parallel to and 12 feet east of the west line of west coal shed extended, and the total length from face of dock to center of old conduit is 182 feet 10 inches. The inside top of conduit is laid to grade, elevation 79 feet city datum, the surface of the ground being 100 to 102. This depth was required in order to obtain good soil for tunneling and permit branches to pass under old conduits. It is also believed to be sufficient to meet any conditions which may arise should filters be built. The dock contains an inlet chamber 10 feet in diameter, from the bottom of which the conduit begins. The conduit contains a junction chamber 12 feet in diameter and a strainer well 18 feet in diameter, with necessary gates. From the junction chamber two branches 5 feet 2 inches diameter are taken, one 61 feet long to the west strainer well supplying Engines No. 1 and 2, and one 61 feet long to a new well to be built on line of old conduit, supplying the same engines. This work, including tunneling, although difficult, and in treacherous soil, was completed without serious accident.

One expensive delay was caused by the failure of a temporary brick bulkhead, the cement being washed out of the joints by the water pressure which came on before the mortar was sufficiently set. The tunnel was flooded and the services of a diver required before work could be resumed. Repairs on the old conduit supplying Engines No. 1 and 2 have been begun, and will include a new concrete dock similar to the one just completed.

This work is all a part of the general plan which includes the proposed 10-foot tunnel, for which specifications are being prepared. When completed and the ground graded the north end of the settling basin will present a neat and finished appearance.

Water Levels.

The extensive improvements at the pumping station, both present and proposed, made necessary a study of the fluctuations in the height of water in the Detroit River. The Water Board records are probably the most complete in existence, and as they have been compiled, corrected, and put in presentable form at the expense of considerable labor, they are here presented in tabular form with full explanatory notes for preservation and convenient reference.

The observation of 1819 was made by Major Henry Whiting, those from 1830 to 1850 by A. E. Hathon, City Surveyor; they may have been single readings, but were probably the mean of several. "The observations made before the engine house was erected were made with reference to a known point, and were afterward referred, by calculation, to the present base" (An. Rept. 1855, p. 10). The engine house referred to was probably the one erected in 1849 at the foot of Orleans street. The 1853 observations were taken on the first of the month given, except December, which is the mean of the 1st and 31st (An. Rept. 1853, p. 18). From 1854 to 1877 inclusive, daily readings were taken by the engineer at the pumping station at the foot of Orleans street.

From 1854 to 1862 inclusive the highest and lowest readings for each month were published yearly (An. Repts. 1854-62), and in the report of 1867 all high and low readings from 1861 to 1867 inclusive are tabulated. Slight changes have been made in the table as published in 1867, for the years 1861 and 1862, to make it agree with the Annual Reports for those years.

The base to which levels were referred was the water table of the engine house at the foot of Orleans street, which

rage .	Consumption Average Gallons Daily. 42,960,381 40,753,598				Consumption Average Gallons Daily. 44,789,213 46,786,577 48,893,551			
	Pressure, lbs.			Fric. Loss lbs.	Pressure, lbs.			Fric. Loss lbs.
Fric. Loss lbs.	High	Low	Average		High	Low	Average	
....	55	40	48.80	....	60	40	49.32	....
....	53	43	48.25	....	60	43	50.27	....
....	..	..	.....	....	60	40	50.43	....
....	..	..	.....	....	..	..	.....	....
....	..	..	.....	....	..	..	.....	....
....	..	..	.....	....	41	29	34.61	2.20
1.85	37	25	32.34	2.16	39	25	32.67	2.35
1.30	37	29	32.67	1.39	38	28	32.76	2.63
....	..	..	.....	....	..	..	33.86	2.38
4.39	35	23	29.61	5.12	35	20	29 38	5.87
3.73	34	26	30.17	4.01	38	23	29.85	6.35
....	..	..	.....	....	..	..	30.12	6.24
4.94	36	20	30.95	5.30	36	20	30.67	6.10
4.08	35	28	31.13	4.57	36	26	30.88	6 84
....	..	..	.....	....	..	..	31.15	6.73
6.00	32	20	27.48	6.96	32	20	27.64	7.32
5.71	30	25	27.86	6.03	34	22	27.76	8.15
....	..	..	.....	....	..	..	27.70	8.37
6.58	35	26	31.38	6 71	35	26	31.30	7.31
5.61	35	27	31.58	5.96	36	25	31 29	8.27
....	..	..	.....	....	..	..	31.37	8.35
5.43	34	25	28.99	5.37	34	24	29.06	6.82
5.39	32	25	28.92	5.89	34	23	29.08	7.80
....	..	..	.....	....	..	..	29.56	7.43
6.08	34	23	29.19	7.03	36	19	29.10	7.64
5.59	34	26	29.44	6.23	35	22	29.11	8.58
....	..	..	.....	....	..	..	28.83	9.02
9.23	33	22	27.99	10.35	33	18	27.59	11.27
8.47	31	24	28.55	9.24	32	19	26.66	13.15
....	..	..	.....	.....	..	..	27.43	12.54
8 86	30	20	24 80	9.79	30	15	24 05	11.06
7.90	29	23	25.52	8.52	29	16	24.31	11.75
....	..	..	.....	....	..	..	24.28	11.94
8.06	30	20	25.75	8.64	30	15	25.15	9.76
6.46	31	23	27.02	6.82	31	17	25.29	10.57
....	..	..	.....	....	..	..	25.98	10.04
9.80	33	21	27.87	10.98	33	16	27.42	11.95
9.12	31	22	28.56	9.74	33	16	27.16	13.16
....	..	..	.....	.....	..	..	26.90	13.58
6.69	33	22	28.20	7.89	33	18	27.75	8.86
5.96	32	25	28.90	6.64	34	17	27.69	9.87
....	..	..	.....	....	..	..	27.45	10.27
8.31	31	20	27 07	9.85	33	17	26.80	10.64
7.98	32	24	27.69	8.68	32	17	26.50	11.89
....	..	..	.....	....	..	..	26.20	12.35
....	..	..	.....	....	..	..	.....	....
0.23	32	22	27.18	0.18	35	21	27.10	2 28
....	..	..	.....	....	..	..	27.82	1.72
0.93	29	20	24.14	1.17	31	14	23.72	2.11
0.06	29	19	24.67	0.09	30	18	24.83	1 95
....	..	..	.....	....	..	..	25.80	1.14
4.48	26	18	21.57	5.06	28	16	21.71	5.42
4.09	26	18	21.65	4.43	27	15	21.75	6.35
....	..	..	.....	....	..	..	21.76	6.50
6.08	24	15	18.88	7.04	25	14	19.11	7.33
5.37	24	16	19.55	5.82	24	12	18.70	8.69
....	..	..	.....	....	..	..	19.60	7.95
5 63	25	12	17.38	6.04	25	11	17.16	6.78
4.86	21	13	17.28	5.59	23	12	17.35	7.54
....	..	..	.....	....	..	..	17.04	8.01
5.82	21	12	18.33	6.34	23	12	18.02	7.17
5.30	23	15	18.44	5.68	23	13	18.40	7.74
....	..	..	.....	....	..	..	18.09	8.21
5.61	22	15	18.66	6.46	24	12	18.67	6.97
5.36	21	16	18.50	5.97	23	14	18.85	7.74
....	..	..	.....	....	..	..	18.14	8.61
9 65	20	12	16.54	10.81	22	8	16.45	11.42
8.58	22	13	17.87	8.93	22	10	16.36	12.46
....	..	..	.....	.....	..	..	17.10	11.88
1.70	29	18	23.94	1.76	32	15	23 50	2.72
0.61	30	21	24.59	0.56	32	19	24.90	1 32
....	..	..	.....	....	..	..	25.79	1.54
....	..	..	.....	...	..	..	.....	....
2 24	24	14	19 04	2.25	25	13	19.00	4.31
....	..	..	.....	....	..	..	20.09	3.38
3.44	21	11	16.54	3.99	22	10	16.11	4.94
2.27	23	13	17 89	2 09	23	12	17.11	4.89
....	..	..	.....	....	..	..	18.86	3.30
4.72	21	11	16.97	5.50	23	11	16.92	6.07
3.07	24	15	19 19	2.73	24	13	17.71	6 23
....	..	..	.....	....	..	..	19.87	4.23
1.98	23	15	18 78	2.80	29	12	18.35	3.85
3.23	26	15	19.74	1.29	26	9	16.48	6.57
....	..	..	.....	....	..	..	20.33	2.88
....	..	..	.....	....	..	..	.....	....
2.47	*23*	*14*	*18.10*	*2.51*	23	13	17.32	5.31

was assumed to have an elevation of 100 feet. The present city levels are referred to the same datum plane as this bench mark and have been ever since it was established. The elevation of engine house water-table by U. S. levels, 1877, was found to be 580.30 above mean tide, N. Y. Harbor.

Until 1877 the zero of gauge remained at an elevation of 100.00 feet, but about this time the gauge was moved from the foot of Orleans street to present pumping works and fastened to a small wooden dock at the head of canal, where the present Belvidere is situated. No record exists of the date, level notes or circumstances connected with this change, although D. Farrand Henry, under whose direction the survey was made, stated in 1900 that a closed line of levels was run which checked reasonably well. Between 1893 and 1897 six careful lines of levels were run from the U. S. B. M. "Detroit," at the foot of Mt. Elliott avenue, to the Hurlbut Memorial Gateway, and the elevation of the zero of the gauge was determined five times, making its elevation 100.477. The U. S. engineers, after an investigation of these records, comparing them with their own readings obtained at various points, conclude the "change in elevation of zero of Water Works gauge from 580.30 to 580.78 did not all take place when gauge was moved in 1878, and no important change is apparent between 1875 and 1881. The change may have been gradual from 1882 to 1886, and probably all of it had taken place by 1889."

In preparing this table, however, it was assumed that an error of 0.477 feet was made in moving the gauge in 1877, and that the gauge had remained at a constant elevation of 100.477 from January, 1878, until tested in 1893, and all figures here published are upon that basis.

In June, 1899, during the construction of the Belvidere, the gauge was again moved and was reset with its zero at an elevation of 100.617, where it still remains.

It is believed that all observations since 1854 have been made daily. The only existing records of those made before

August, 1865, are found in the Annual Reports. Since the latter date two readings have been taken each day, morning and evening, and readings are on file in this office.

The "High" column gives the highest single elevation observed during the month. The "Low" column gives the lowest single elevation observed during the month. The "Mean" column, the average of two readings a day for the entire month. Figures in bold faced type give the highest and lowest single elevations observed during each year. The highest recorded elevation of the river since 1819 is 97.8 feet on December 19–20, 1876, and the lowest recorded elevation is 89.9 feet, on February 11, 1896. All elevations given in table are referred to present city base.

Drafting Room.

The work in the drafting room during the past eighteen months has been unusually heavy, owing to the several undertakings of considerable magnitude that have been projected and that are now either completed or in the course of construction. The engineering work incident to these, in connection with the general routine work of the office, has constituted the greater part of the labors of this department. The following items show in brief some of the work done during the period:

1. Determination of the flow of water in the various large mains by Pitot tube, and the regulation of same in order to equalize pressures.
2. Estimates of cost of all proposed work, including petitions for pipe, conduits, extensions and engineering structures of various kinds.
3. Design of all gates, valves, specials, pipes, conduits and wells used or constructed and careful foundry inspection of all cast-iron and composition castings, and machine shop inspection of all finished work. This work, owing to its

extent and nature, has required more than usual care and fidelity.

4. Accurate field records of all pipes and specials laid, including the distribution system of the Village of River Rouge and the work at the pumping station.

5. Necessary surveys and levels for all construction, including a complete survey of the proposed route for a pipe line from Detroit to supply the Wayne County House and the Villages of Wayne and Dearborn, also levels and survey connected with conduits and high-pressure main.

6. Drawing and keeping posted to date tracings of each street intersection in the city, showing size and location of all water pipes and such other construction as is likely to affect the repair, alteration, or extension of water pipes.

7. Complete records of the quantity of water used daily for ordinary and fire consumption, together with the pressures throughout the city and the reduction and tabulation of same.

8. Making and posting maps, plats, plat books, atlas and inspection maps.

9. Furnishing each Water Works foreman and tapper and each Detroit Fire Department foreman with a sectional map of the city and suburbs, 43 sheets, scale 300 feet to one inch, showing all water pipes, with sizes, gates, hydrants, reservoirs, sprinkling hydrants and blow-offs.

10. River survey, including daily observations of temperature and turbidity during summer of 1900, and borings on route of proposed tunnel.

11. Special investigations and reports on the subject of water-hammer, breaking of pipes under pressure, tunnel, and proposed extensions outside of limits.

12. Number of blue-prints given out............	1,628
Number of blue-prints filed in vault, about....	900
Total blue-prints taken.................	2,528

In conclusion, attention is called to a technical paper of joint authorship published in the May number of the Proc. Am. Soc. C. E., and to be presented before that society at New York City on Sept. 4, 1901. This paper describes in detail, and at some length, experiments conducted at Detroit on the flow of water in pipes and especially an investigation of the resistance which curves of different radii offer to the flow of water. They are the only experiments of the kind conducted on large pipes, and are of extreme technical interest in that they show, contrary to all heretofore accepted practice and theory both in this country and in Europe, that a curve of long radius offers more resistance to flow than does one of short radius.

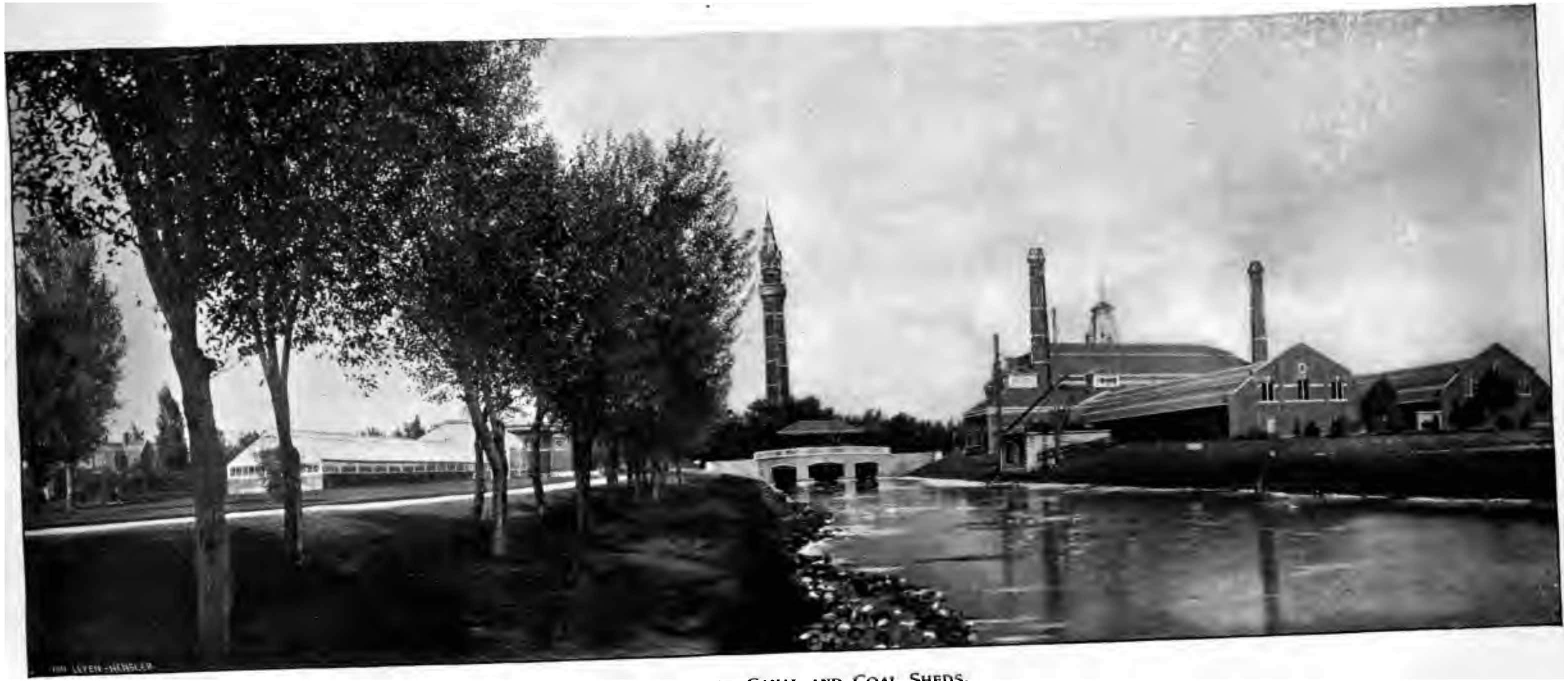
The curves experimented upon which gave the least resistance had a radius of 2 to 3 diameters only, instead of 8 to 10 diameters, formerly considered good practice.

As curved pipe costs at present prices $63.00 per ton and straight pipe only $22.00, the direct financial benefit to the Board from these experiments was a saving of over $3,000.00 in the contract for specials required for the 42-inch force main now being constructed.

In submitting this report I desire to acknowledge the many courtesies received from your honorable body and the loyal co-operation of my associates in the work.

All of which is respectfully submitted.

CLARENCE W. HUBBELL,
Civil Engineer.



GREENHOUSE, CANAL AND COAL SHEDS.

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

Detroit, July 1, 1901.

To the Board of Water Commissioners:

Gentlemen—In compliance with the rules and regulations of your honorable body, I herewith report the work done in the Meter, Inspection and Service Cocks Department from January 1, 1900, to July 1, 1901:

NUMBER OF METERS PLACED FROM JANUARY 1, 1900, TO JULY 1, 1901.

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
In service Jan. 1, 1900	3,122	1,037	829	235	195	82	45	10	5,555
Placed from Jan. 1 to June 30, 1901	178	36	84	26	30	8	4	......	366
	3,300	1,073	913	261	225	90	49	10	5,921
Removed from Jan. 1st to June 30. 1901	190	32	38	7	15	1	3	......	286
Total number in service June 30, 1901	3,110	1,041	875	254	210	89	46	10	5,635

IN SERVICE JUNE, 30, 1901.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson	3,065	1,021	798	242	182	73	31	10	5,422
Crown	28	13	37	9	8	7	3	......	105
Hersey	1	3	30	2	10	2	8	......	56
Worthington	8	4	10	......	9	7	2	......	40
Union Rotary	7	......	......	1	1	......	1	......	10
Buffalo	1	......	......	......	......	......	......	......	1
Venturi	......	......	......	......	......	......	1	......	1
Aggregate	3,110	1,041	875	254	210	89	46	10	5,635

Indicators attached to hydraulic elevators	40

METERS IN STOCK.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson	8	......	7	4	5	3	2	1	30
Crown	......	......	1	2	3	2	1	......	9
Hersey	......	......	8	......	2	......	......	......	10
Worthington	......	......	......	......	1	......	......	......	1
Union Rotary	1	......	......	......	......	......	......	......	1
Aggregate	9	......	16	6	11	5	3	1	51

Valuation of meters in stock July 1, 1901		$2,146 00
Valuation of material on hand July 1, 1901		539 22
Valuation of tools, etc., July 1, 1901		466 92
Valuation of horse, wagons, etc., July 1, 1901		273 00
Valuation of furniture, fixtures, etc., July 1, 1901		105 00
Total valuation of stock on hand July 1, 1901		$3,530 14
Valuation of meters in service January 1, 1900		$100,204 74
Deduct 5 per cent for depreciation in value	5,010 24	
Deduct for meters sold	289 36	5,299 60
		$94 905 14
Add amount expended during the year for meters placed since January 1, 1900		4,172 61
Total valuation of meters in service July 1, 1901		$99,077 75

SUMMARY OF TOTAL AMOUNT EXPENDED IN THE METER DEPARTMENT FOR THE YEARS 1889 TO JULY 1, 1901, INCLUSIVE.

	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900-1	TOTAL
Meters	$11,175 00	$18,700 00	$6,501 55	$12,871 82	$6,987 43	$8,824 08	$9,235 11	$10,435 76	$7,955 97	$1,790 75	$2,265 70	$4,172 61	$100,415 78
Supt. and labor,	1,734 10	8,510 57	4,841 49	8,269 17	8,980 46	6,672 20	6,647 89	6,340 08	6,078 78	4,531 11	4,223 54	6,369 45	73,198 86
Material, tools, etc............	637 26	2,982 14	872 99	2,132 98	1,650 33	1,833 01	1,384 85	1,035 15	927 90	568 99	375 32	617 71	15,018 58
Freight, hauling, etc............	98 05	408 97	197 11	244 08	165 12	201 18	71 40	91 11	67 90	13 16	6 85	15 00	1,579 93
Horses, wagon, etc............	....	....	....	547 24	184 50	383 07	248 60	238 51	330 80	187 50	244 25	321 15	2,685 62
Aggregate..	$13,644 41	$30,601 68	$12,413 14	$23,565 24	$17,967 86	$17,913 54	$17,587 85	$18,140 61	$15,361 35	$7,091 51	$7,115 66	$11,495 92	$192,898 77

Since January 1, 1900, we have placed 366 meters and removed 286, making a net increase of 80, which, added to the number in service previous to that date, makes a total of 5,635 in service on July 1, 1901. There are 807 meters on premises that pay by the assessed rates as against 1,113 the date of our last report. One hundred and thirty meters have been removed from such premises and placed on such business places as required metering, and 176 consumers who changed from meter to assessed rates, and where the meters were allowed to remain on the premises, have been transferred back to the meter roll on account of their large consumption. A case in point is that of a private family where their consumption was 435,000 gallons in three months, which by meter rates would amount to $10.83, while the assessed rate for same length of time was only $1.78. After placing premises on meter roll the consumption was reduced to 9,000 gallons for three months instead of 435,000 gallons as formerly. This is not an uncommon occurrence on metered premises, and it seems to be the experience of nearly all cities throughout the country, and is causing many of them to adopt the meter system, that being the only practicable way of stopping the enormous waste that is continually taking place. With all service connections metered, the necessity of "leak inspectors" would cease, the meter being the best leak detector known.

The per capita consumption still continues to increase each year since we stopped metering private houses in 1897. In 1900 the per capita consumption was 153 gallons daily, in 1899, 147 gallons; 1898, 135 gallons; 1897, 125 gallons. From 1889 to 1897 the per capita consumption decreased each year (with one exception) as the number of meters increased, which would seem to prove the efficacy of the meter system in preventing waste.

The city of Milwaukee, with a population about the same as Detroit, consumes only 88 gallons per capita, owing to the use of 30,000 meters. Could our city be reduced to the same quantity we would only have to pump an average of 28,000,000 gallons daily, instead of 48,000,000 as we are now pumping, the difference being enough to supply a city of 225,000 inhabitants.

When meters were first being introduced the idea was that their life would be about ten years, but after the lapse of that time we find those that have been in service that number of years are still just as good as ever, to all appearances. We deducted ten per cent each year for several years for depreciation in value, and later reduced it to five per cent, which amount still seems too high.

A 4-inch meter was removed a few days ago from an abandoned service, and which had been in constant operation for over ten years and had registered over 78,000,000 gallons. It had been repaired but once, the disc having been adjusted and train gear repaired, all of which was done in less than a day. It was tested with a new 1½-inch meter, and on 750 gallons it was only one-half of one per cent slow, and that before anything had been done to it in the way of cleaning or repairs. On a ⅝-inch stream it was about four per cent slow, but after it had been cleaned and adjusted it registered within two per cent on ⅛-inch flow, all of which goes to show that, with a reasonable amount of repairs, the life of a meter is almost indefinite.

Inspection.

No change has been made in this department, the work being done along the same lines as shown in our last report.

The work of the Inspectors increases each year in conformity with the growth of the city, and it will probably be advisable to make some changes in the work assigned them, in order to comply with the many different duties they are now called upon to perform, which (in some wards, at least) is more than one Inspector can accomplish.

The following will show a portion of the work done by the Inspectors since January 1, 1900:

New connections examined	2,065
Extensions examined	1,011
Buildings inspected	4,811
Fixtures inspected	6,655
Let on vacancy, and non-payment	2,253
Let on new connections	1,615
Building tax notices	2,736
Delinquents notified	103,922
Shut for non-payment	1,228
Shut for vacancy	710
Inquiries for collectors	17.542
Meters read	33,236
Meter bills delivered	24,873
Examination for leaks	13,326
Leaks reported	1,766
Shut for leaks	309
Total	218,058

Service Cocks.

Nineteen hundred and seventy two (1972) service connections were made since January 1, 1900, and seventy-five (75) were discontinued, making the total number of service connections in the city on the first day of July 1901, 57,237.

Receipts for service cocks from January 1, 1900, to July 1, 1901	$5,611 00
Received for plumber licenses	1,094 50
Received for labor and material sold	178 89
Total receipts service cocks department	$6,884 39

TABLE showing the number and sizes of taps inserted in each ward from January 1, 1900, to July 1, 1901.

INSERTED.	WARDS.																	Total.
SIZES.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
⅝-inch	58	12	48	16	47	28	40	71	84	105	55	98	143	115	71	232	162	1,385
1-inch	95	42	17	38	31	24	16	23	22	32	13	28	22	14	28	15	49	509
2-inch	9	5	...	2	3	3	1	1	2	5	...	3	1	1	2	2	2	42
3-inch	4	5	1	2	...	1	1	1	1	2	2	...	...	...	...	3	...	23
4-inch	...	1	...	...	...	1	1	1	2	...	...	1	...	..	2	...	...	9
6-inch	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
Aggregate	168	67	66	58	81	57	59	97	111	144	70	130	166	130	103	252	213	1,972
DISCONTINUED.																		
⅝-inch	15	4	3	3	7	5	6	4	4	1	2	3	1	1	1	...	1	61
1-inch	5	5	...	1	...	...	...	...	...	...	1	...	...	...	2	...	...	14
Aggregate	20	9	3	4	7	5	6	4	4	1	3	3	1	1	3	...	1	75

TABLE SHOWING THE NUMBER OF SERVICE CONNECTIONS IN USE JULY 1ST, 1901.

	No. in Use Jan. 1, 1900.	Added in 1900-1	Discontinued in 1900-1	Total in Use July 1, 1901.
⅝-inch	40,438	1,385	61	41,762
1 "	14,280	509	14	14,775
2 "	297	42	....	339
3 "	168	23	....	191
4 "	129	9	....	138
6 "	27	4	....	31
10 "	1	....	....	1
	55,340	1,972	75	57,237

TABLE SHOWING SERVICE CONNECTIONS IN HIGHLAND PARK, DELRAY AND RIVER ROUGE VILLAGES.

	Inserted in 1900-1.			Previous to 1900.						TOTAL.
	⅝-in.	1 in.	2-in.	⅝-in.	1-in.	2-in.	3-in.	4-in.	6-in.	
Highland Park.	13	6	1	26	31	...	1	...	...	78
Delray.........	230	18	1	393	46	2	2	1	4	697
River Rouge...	130	1	...	...	...	...	...	...	...	131
Aggregate	375	25	2	419	77	2	3	1	4	906

The villages of Delray and River Rouge, make their own service connections. They have adopted our rules and regulations governing plumbers.

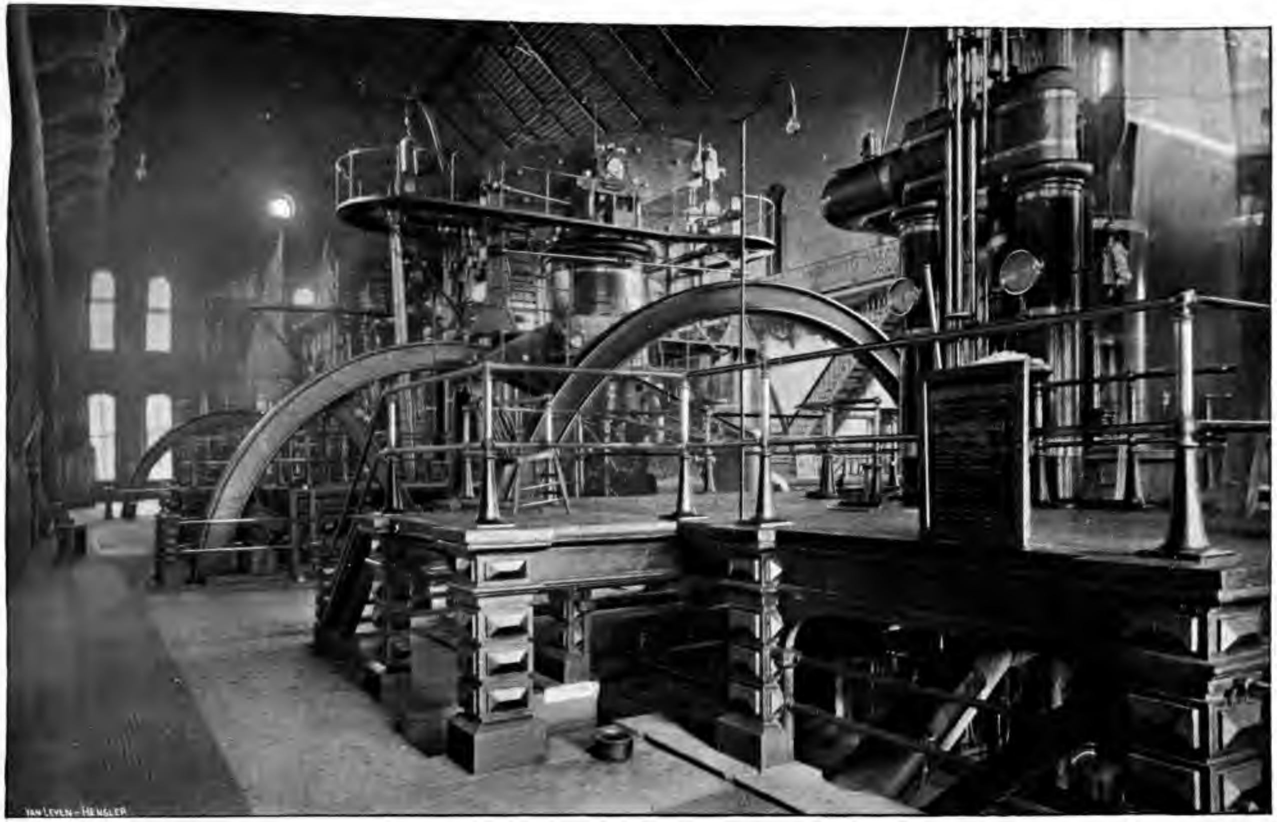
We still make all service connections for Highland Park, but they do their own inspection work, under rules similar to ours.

Each village takes its supply through meters, which removes the necessity of our inspection, so far as our city is concerned.

Attached to this report is a complete list of tools on hand, and an itemized account of material in stock in the meter and inspection departments on the 1st day of July, 1901.

All of which is respectfully submitted.

T. R. PUTNAM,
Supt. Meters and Inspection.



Engine Room

REPORT OF CHIEF ENGINEER AT PUMPING WORKS.

To the Board of Water Commissioners:

Detroit, July 1, 1901.

Gentlemen—I have the honor to submit the Engineer's report for the year 1900 and for first six months of 1901.

The following table shows the number of gallons of water pumped, and cost of fuel for the years named:

YEAR.	GALLONS OF WATER PUMPED.	COST OF FUEL CONSUMED.	AVERAGE DAILY DELIVERED.
1852	235,840,271	....	646,411
1853	303,531,743	$2,129 37	931,594
1854	376,265,126	2,271 34	1,030,866
1855	542,807,364	3,825 81	1,487,143
1856	692,124,305	4,017 44	1,896,231
1857	697,190,523	3,993 20	1,909,837
1858	718,091,207	3,655 20	1,967,373
1859	782,112,587	3,194 15	2,142,774
1860	870,036,451	4,196 21	2,383,580
1861	895,129,423	4,414 07	2,452,409
1862	994,945,329	3.150 95	2,725,878
1863	1,035,798,043	4,670 86	2,837,803
1864	1,018,390,256	7,647 62	2,839,078
1865	1,049,514,887	7,372 89	2,875,383
1866	1,196,317,922	9,349 16	3,277,583
1867	1,425,535,230	10,121 82	3,905,576
1868	1,666,545,125	11,379 23	4,507,248
1869	1,946,810,325	11,247 92	4,511,809
1870	1,866,060,068	12,713 78	5,112,493
1871	2,300,150,605	14,681 05	6,301,782
1872	2,782,292,578	17,736 86	7,601,892
1873	3,198,393,948	20,233 30	8,762,723
1874	3,289,872,635	20,431 71	9,013,350
1875	4,207,454,260	21,393 98	11,527,272
1876	4,065,134,470	19,832 89	11,107,499
1877	4,213,239,790	17,433 72	11,543,123
1878	4,345,743,330	10,943 82	11,906,146
1879	5,129,599,110	11,219 51	14,053,696
1880	5,552,965,310	12,276 60	15,172,036
1881	6,543,127,968	16,556 63	17,926,377
1882	6,284,000,742	13,156 16	17,261,440
1883	7,379,327,188	16,495 99	20,217,334
1884	8,510,614,140	19,877 07	23,253,044
1885	9,970,829,580	21,341 48	27,317,341
1886	10,576,571,254	20,887 24	28,976,907
1887	13,168,859,808	35,882 83	36,079,166
1888	14,380,166,670	39,568 66	39,397,716
1889	12,875,334,453	34,413 31	35,274,888
1890	12,120,944,532	31,852 40	33,209,067
1891	12,057,261,236	33,826 86	33,033,592
1892	12,476,612,482	31,034 40	34,182,499
1893	13,877,977,208	27,479 93	38,021,855
1894	13,649,779,605	29,283 47	37,396,656
1895	14,698,451,954	32,095 00	40,269,731
1896	13,254,369,371	31,186 17	36,215,123
1897	12,928,821,326	17,355 58	35,421,428
1898	14,278,682,058	17,880 19	39,092,252
1899	16,348,062,701	19,011 67	44,789,212
1900	17,077,100,477	25,398 50	46,786,576
January 1 to July 1, 1901	8,849,732,755	16,881 31	48,893,551

The following tables show in detail the work done by each engine each month of the year:

ENGINE No. 1.

MONTHS.	Time run.		Revolutions.	Gallons Water.
	H.	M.		
January	356	45	189,075	169,621,290
February	347	40	195,415	211,630,110
March	244	50	143,250	142,769,700
April	336	40	192,145	218,763,960
May	307	35	169,586	150,603,126
June	373	35	212,063	208,697,436
July	458	50	268,196	317,102,580
August	415	35	244,860	281,202,480
September	247	45	148,081	156,052,242
October	265	....	151,809	121,517,958
November	447	15	257,050	298,643,850
December	487	30	283,630	326,786,922
Total	4,289	....	2,455,160	2,603,391,654

JANUARY 1ST TO JUNE 30TH, 1901.

January	305	30	179,472	181,873,902
February	542	45	324,179	392,456,184
March	449	25	260,217	278,062,612
April	242	15	137,649	130,140,762
May	585	10	332,875	425,176,380
June	398	20	235,134	276,373,434
Total	2,523	25	1,469,526	1,684,103,274

ENGINE No. 2.

January	......	....	....	....
February	230	20	152,255	149,940,480
March	438	05	283,755	338,923,440
April	540	45	337,980	455.005,440
May	733	10	483,470	628,780,920
June	654	20	435,968	587,112,936
July	67	15	41,804	40,325,304
August	43	65	27,765	22,656,240
September	102	....	67,614	80,639,784
October	421	50	272,060	327,456,576
November	705	30	444,615	654,119,280
December	559	45	359,474	551,890,272
Total	4,497	05	2,906,780	3,336,850,672

JANUARY 1ST TO JUNE 30TH, 1901.

January	127	10	81,736	69,935,856
February	224	10	145,247	202,231,992
March	62	40	37,854	30,888,864
April	621	30	399,856	519,739,584
May	279	05	158,256	152,437,536
June	438	50	269,759	360,296,256
Total	1,753	25	1,092,708	1,335,530,088

ENGINE No. 3.

MONTHS.	Time run.		Revolutions.	Gallons Water.
	H.	M.		
January	730	50	434,935	738,427,950
February	635	....	389,415	695,879,080
March	588	20	364,935	652,900,430
April	433	05	258,865	460,942,240
May	......	....	....	....
June	130	....	78,410	135,830,860
July	687	25	428,540	682,625,810
August	712	20	439,730	706,537,740
September	704	50	438,120	672,425,960
October	388	....	237,838	358,721,310
November	......	....	....	....
December	122	50	77,879	122,179,566
Total	5,132	40	3,148,667	5,226,470,946

JANUARY 1ST TO JUNE 30TH, 1901.

January	787	20	478,230	855,391,680
February	449	30	283,478	508,180,072
March	733	05	454,530	787,090,840
April	287	55	177,657	319,782,600
May	744	....	462,420	825,950,220
June	651	....	414,860	723,686,306
Total	3,602	50	2,271,175	4,020,081,718

ENGINE No. 4.

January	733	25	707,570	555,442,450
February	648	45	631,055	495,378,175
March	701	35	682,160	535,499,525
April	182	20	181,860	142,760,100
May	744	....	724,725	568,080,950
June	589	20	588,208	461,743,280
July	626	50	669,580	525,614,805
August	742	45	736,415	578,085,775
September	718	55	702,315	551,270,175
October	708	30	677,796	532,069,860
November	288	....	257,245	201,937,325
December	370	15	334,401	262,504,785
Total	7,054	40	6,893,330	5,410,387,205

JANUARY 1ST TO JUNE 30TH, 1901.

January	661	....	613,210	481,369,850
February	588	....	546,150	428,727,750
March	623	45	591,318	464,184,630
April	432	55	408,397	320.591,645
May	......	....	....	....
June	153	45	146,680	115,143,800
Total	2,459	25	2,305,755	1,810,017.675

TOTAL EXPENSE FOR PUMPING WATER FOR 1900.

Fuel, coal consumed	$25,398 50
Salaries, engineers et al	21,218 53
Repairs, boilers and machinery	269 80
Supplies, oil and waste	797 17
Supplies, boiler	270 33
Supplies, hose	16 74
Supplies, soap, polish, etc	78 47
Supplies, electric light	79 30
Supplies, white lead and paint	11 92
Supplies, farrier	7 00
Supplies, stationery	13 55
Supplies, ice	28 00
Horse expense	30 35
Boiler inspection	37 50
Express charges	1 41
Telephone rental	9 05
Total	$48,267 62

The cost of fuel per million gallons pumped is $1.48, and per million gallons pumped 100 feet high is $1.28.

The table shows that the amount of water pumped during the year was 17,077,100,477 gallons, which is an increase of .04 per cent compared with that of 1899.

The total expense for pumping water, including heating, lighting, etc., was $48,267.62, thus making the cost per million gallons pumped $2.83, an increase of 8 per cent from that of 1899, which I consider is a good showing when we take into consideration that the average price of coal per ton for 1900 has been 16 per cent higher than that of 1899.

The station duty of coal consumed for all purposes for 1900 was 89,009,724 foot pounds.

The engines are all in a fair condition and show a good duty, as will be seen by this report.

There has been but one accident to the machinery the past year at the station, that of No. 2 engine's shaft giving away December 24th, which was replaced by one an inch larger in diameter. While having the crank off we had the holes rebored and a new crank pin put in, which was very desirable, and now feel relieved of a great deal of anxiety, knowing it would have been only a question of a short time till it would have given out. Fortunately the Board had ordered one in advance, therefore was able to make repairs quite rapidly. In connection with this break it was very fortunate that the water connection was built last year between Nos. 2 and 3 engines' wells, so as to be able to put No. 3 in service while still working at its conduit and for that of the new engines.

All of the boilers are in good condition. The four vertical water tube boilers, built by Wickes Bros., of Saginaw, Mich., which were placed in the east room last year to take the place of the four marine fire-box type of boilers, were tested last March and have been giving satisfactory service ever since.

The boiler room and coal sheds are in a fair condition.

I have not been able to accomplish what was desired the past year, that of changing No. 1 and No. 2 engines as per last report, but hope in the near future to be able to give it more attention, and design and make drawings for same.

TOTAL EXPENSE FOR PUMPING WATER, JANUARY 1 TO JULY 1, 1901.

Cost of fuel consumed	$16,881 31
Salaries, engineers et al	10,916 10
Repairs shaft, grate bars, etc	1,108 13
Supplies, engine oil and grease	242 29
Supplies, kerosene oil and gasoline	27 32
Supplies, waste, rags and packing	191 42
Supplies, boiler and engine	90 51
Supplies, electric light fixtures	1 20
Supplies, stationery and postage	6 95
Supplies, horseshoeing	4 00
Supplies, paint, lead, etc	20 03
Boiler inspection	36 00
Total	$29,574 84

The cost of fuel per million gallons pumped is $1.90, and per million gallons pumped 100 feet high is $1.60.

The table shows that the amount of water pumped during the first half of the year was 8,849,732,755 gallons, which is 4 per cent more than one-half of the water pumped for 1900. The total expense for pumping water, including heating, lighting, etc., was $29,574.84, thus making the cost per million gallons pumped $3.34, an increase of 15 per cent from that of 1900. The figures also show that we were using the high price coal, which was not all consumed until June 29, of the present year.

The cost of coal in the sheds used during the last six months was $3.29 per ton, but coal which we are now using is $2.31 per ton, with about the same efficiency. The difference in the price will reduce the cost considerably the coming year.

The engines, boilers and building are in the same condition as formerly.

The twenty-ton crane, which was installed this summer, will certainly be very convenient for the works, and the reconstruction of the gallery has improved the building both in appearance and strength.

URIAH GOULD,
Chief Engineer of Pumping Station.

[illegible]

REPORT OF THE SUPERINTENDENT OF CONSTRUCTION.

To the Honorable the Board of Water Commissioners of the City of Detroit:

Gentlemen—In accordance with the regulations of your honorable body, I herewith report the work done by the Construction Department as shown by the records of this office from January 1, 1900, to July 1, 1901:

Pumping Works.

The following is a statement of work done at the pumping station and grounds between above dates:

Conduit between Engines Nos. 2 and 3, begun in November, 1899, mentioned in that year's report, and completed in March, 1900.

Temporary partition at east end of engine house for the protection of machinery during the building of new addition; work done in January, 1900.

Taking down east wall of engine house and cleaning and piling stone, brick, etc.

Connecting No. 3 Engine to old conduit with specials and setting two hydraulic gates.

New junction well begun in January, 1901, and completed June 8, 1901.

Additional conduits and wells as planned by the Engineer; work was begun in March, 1901. Also a coffer dam in settling basin.

Basin intake well No. 3 constructed in settling basin, including concrete abutments, from May 1 to June 3, 1901.

Two hundred and seventy feet of the conduit have been completed since March, 1901, the excavation for which was done by tunneling.

New strainer well No. 4, 18 feet diameter by 29 feet deep, containing two 60-inch gates.

Repairs to strainer well No. 1, from June 10 to 15, 1901.

Repairs to strainer well No. 2, from May 25 to June 10, 1901.

The old basin intake No. 1, built in 1873, has been coffer dammed and new well is now being constructed at that point, and a system of drainage pipes connecting the strainer and junction wells and conduits with pump to be placed in strainer well No. 2, as is also a new junction well intersecting the old and new conduits.

Other work includes construction for drainage, building roads, removing and rebuilding hose houses and fences, building clock house and tool houses, repairing sprinkling system, etc.

Distribution System.

The pipe laid outside the city during the past year and a half was as follows:

In the Village of Delray, 3,093 feet; 1,536 feet of this pipe was laid of 8-inch to take the place of the same amount of 6-inch, which was discontinued, for the purpose of continuing the laying of water mains through River Rouge Village, the net increase of pipeage in Delray being 1,557 feet.

In the Village of River Rouge we laid 32,500 feet, and in the Township of Greenfield 315 feet.

The total added to the system outside of the city in the year and a half was 34,372 feet.

Inside the city limits we laid 25,199 feet and discontinued 1,504 feet of small pipe, making a net increase inside of city of 23,695 feet.

The net increase in the entire system being 58,067 feet, or $10\frac{5267}{5280}$ miles.

The Board now owns 39 4192/5280 miles outside of city and inside 531 3880/5280 miles, making a total of pipe in system of 571 2792/5280 miles of the different sizes, as follows:

Size of Pipe, Inches.	Measured Length in Feet for 1899.	Length in Feet Laid from January, 1900, to July, 1901.	Discontinued Feet from January, 1900, to July, 1901.	Total Length in Feet to July, 1901.
45	103	....	....	103
42	59,491	888	12	60,367
36	715	....	....	715
30	54,494	12	12	54,494
24	84,587	....	....	84,587
20	393	....	....	393
18	87	....	....	87
16	53,805	....	....	53,805
12	37,562	....	....	37,562
10	159,583	92	60	159,615
8	314,856	8,088	40	322,904
6	1,334,581	37,912	2,286	1,370,207
4	791,376	14,087	199	805,264
3	63,633	19	431	63,221
2	4,339	9	....	4,348
Total,	2,959,605	61,107	3,040	3,017,672

Division of System into High and Low Pressure Areas.

FEET OF PIPE LAID.

4-inch pipe	2,229 feet.
6-inch "	4,952 "
8-inch "	3 "
10-inch "	13 "
Total	7,197 feet.

COST.

Pipe	$3,617 10
Specials—45 Tees, 2 Crosses, 91 Curves, 45 Sleeves, 46 Reducers, 30 Plugs, 45 Smith Sleeves, 59 Service Cocks	773 65
Gates	693 10
Lead	609 70
Sundries	59 61
Gate-wells	1,561 82
Hauling	146 81
Repaving	53 57
Labor	3,935 17
Superintending and Engineering	359 85
Total	$11,810 38

Pipe Laid for Village of River Rouge.

FEET LAID.

4-in. Pipe	7,081 feet
6-in. "	19,595 "
8-in. "	7,410 "
Total	34,086 "

COST.

Pipe	$13,934 49
Gates	966 00
Specials	2,872 61
Lead	1,441 20
Superintending and Engineering	1,000 00
Hauling	660 04
Labor	6,205 17
Contract for laying pipe under Rouge River	1,685 00
Gate-Wells	1,085 83
Sundries	133 65
Total	$29,983 99
Credit 1536 feet of pipe at 40c. per foot as per agreement	613 20
Net Cost	$29,370 79

At the close of this report will be found a descriptive list of the different lines of pipe laid, with locations, lengths, size and cost of construction in detail.

There have been placed since January 1, 1900, 21 tees for the use of the Fire Department.

Gates.

The total number of gates now in the distribution system amounts to 6,899 of the different makes and sizes, as follows:

GATES IN SYSTEM JULY 1ST, 1901.

SIZE.	42-IN.	36-IN.	30-IN.	24-IN.	20-IN.	18-IN.	16-IN.	12-IN.	10-IN.	8-IN.	6-IN.	4-IN.	3-IN.	TOTAL.
Murdock	5	...	11	16	...	...	27	48	188	457	1,631	1,325	11	3,719
Flowers	20	...	9	18	...	...	...	...	39	52	241	433	20	832
Galvin	...	1	7	12	...	...	21	...	13	31	170	255	1	511
Michigan Brass and Iron Works	10	...	9	2	11	...	13	11	63	151	769	114	...	1,153
Pittsburg	...	...	...	15	...	2	1	1	10	11	31	123	...	194
Roe Stephens	...	...	...	...	...	...	...	6	....	4	43	....	...	53
Eddy	...	...	...	...	...	...	...	...	15	4	6	9	...	34
Scowden (Scott)	...	...	...	...	...	...	...	...	8	19	48	12	...	87
Ludlow	...	...	...	...	...	...	...	...	1	2	9	8	...	20
St. Louis	...	...	...	...	...	...	...	3	....	....	....	....	...	3
Detroit Water Works	...	...	...	...	...	...	...	...	2	29	146	67	...	244
Prong	...	...	...	...	..	...	...	...	....	....	1	....	...	1
Boston	...	...	...	...	...	...	...	...	....	1	1	....	...	2
Newport	...	...	...	...	...	...	...	...	....	....	....	1	...	1
No Name	...	...	...	...	...	...	...	...	....	3	9	32	1	45
TOTAL	35	1	36	63	11	2	62	69	339	764	3,105	2,379	33	6,899

There were added to the distribution system from Jan. 1, 1900, to July 1, 1901, 112 gates, as shown by the following table:

GATES SET FROM JANUARY 1, 1900, TO JULY 1, 1901.

	4 in.	6-in.	8-in.	10-in.	TOTAL.
Detroit Water Works	27	57	10	2	96
Michigan Brass and Iron Works	2	5	...	...	7
Murdock	2	...	...	...	2
Scott	...	4	...	1	5
Pittsburg	...	1	...	...	1
Flowers	...	1	...	...	1
Total	31	67	10	3	112

GATES SET IN RIVER ROUGE, FROM JANUARY 1, 1900, TO JULY 1, 1901.

	4-in.	6-in.	8-in.	TOTAL.	REMARKS.
Detroit Water Works	28	31	10	69	Shut-offs.
" " "	1	...	...	1	Blow-offs.
Total	29	31	10	70	

GATES SET AND RE-SET IN DELRAY, FROM JANUARY 1, 1900, TO JULY 1, 1901.

KIND.	4-in.	6-in.	8-in.	TOTAL.	REMARKS	
Detroit Water Wks	1	1	1	3	Set New.	Shut-off.
" " "	1	...	...	1	" "	Blow-off.
Murdock	3	...	...	3	Re-set.	" "
Total	5	1	1	7		

There were taken out of the system 41 gates, as shown by the following table:

TABLE OF GATES TAKEN OUT OF SYSTEM, FROM JANUARY 1, 1900, TO JULY 1, 1901.

No. of each kind.	KIND.	SIZE.	REMARKS.	
3	Murdock	8-in	Shut-off	System.
9	"	6-in	"	"
3	Michigan Brass and Iron Works	6-in.	"	"
1	Galvin	6-in.	"	"
3	"	4-in.	"	"
14	Murdock	4-in.	"	"
1	Scott	4-in.	"	"
7	Murdock	4-in.	Blow-off	"
41	Total.			

There have been set and re-set for blow-offs from January 1, 1900, to July 1, 1901, 25 gates, as shown by the following table:

GATES SET AND RE-SET FOR BLOW-OFFS, FROM JANUARY 1, 1900, TO JULY 1, 1901.

No. of each kind.	KIND.	SIZE.	REMARKS.	
1	Detroit Water Works	6-in.	Set	New.
9	" " "	4-in.	"	"
1	Ludlow	4-in.	"	"
5	Murdock	4-in.	"	"
2	Flowers	4-in.	"	"
6	Murdock	4-in.	Re-set.	
1	Ludlow	4-in.	"	"
25	Total.			

The following is a statement of work of the men employed in the examinations, operations and repairs of gates, gate wells, gate boxes, etc.:

January 1, 1900, to July 1, 1901.

12,644 gates were examined.
340 gates were out of order Jan. 1st, 1900.
526 gates were out of order since Jan. 1st, 1900.
796 gates were repaired.
41 gates were fitted with larger heads to stem.
107 gate wells were built over gates on new lines.
335 gate wells were built over gates on old lines.
12 gate wells were enlarged.
87 gates were cleaned.
10 wood boxes were replaced with iron boxes.
473 Boxes were readjusted to grade of street.
10,347 blow-offs were operated for blowing off dead ends.
1,824 gates were shut and opened for flushing.
6,640 gates were shut and opened for various purposes.
126 blow-offs were repaired.
2,265 wells in system.

Total and average cost of wells built over gates from January 1, 1900, to July 1, 1901:

		Total Cost.	Average Cost.
	Over Gates in Old Lines.		
15	gate wells, 10 in., 12 in., and 16 in. gates.	$ 477 51	$ 31 80
317	gate wells, 4 in., 6 in. and 8 in. gates....	8,105 63	25 57
2	gate wells, 3 in. gates..................	47 85	23 92
1	gate well, 1 in. air cock.................	17 56	17 56
335		$ 8,648 55	
	Over Gates in New Lines.		
1	gate well over 10 in. gate..............	$ 29 47	$ 29 47
106	gate wells over 4 in., 6 in. and 8 in. gates.	2,209 66	20 84
	Meter well, River Rouge...............	189 08	189 08
107		$ 2,428 21	
	Total cost 442 gate wells..............	$11,076 76	

Leaks in Mains from January 1st, 1900, to July 1st, 1901.

Between the above dates, 18 leaks were repaired in the mains of the distribution system, as follows:

DATE.	LOCATION.	SIZE.	COST.
1900			
Feb. 27	Bagg, bet. Brooklyn and Trumbull..	24-in. main	$127 30
April 8	Dubois and Guoin	10-in. "	31 04
April 24	Pumping Station	42-in. "	69 20
May 4	Dubois and Woodbridge	6 in. "	30 46
May 5	Dubois and Woodbridge	6-in. "	17 66
Sept. 12	Congress and Mt. Elliott	42-in. "	350 90
Sept. 12	Woodward and Duffield..............	10 in. "	41 17
Sept. 16	Woodward and Winder..............	10 in. "	23 39
Sept. 27	Woodward and Duffield.............	10-in. "	39 99
Oct. 9	Woodward, near High	10-in. "	32 78
Nov. 3	Twenty-seventh and Buchanan	30-in. "	234 81
Nov. 4	Twenty-seventh and Buchanan	30-in. "	174 40
Dec. 11	Jefferson and Holcomb	42-in. "	340 61
Dec. 21	Jefferson and Griswold	16 in. "	10 19
1901			
March 25	Dubois and Maple..................	8-in. "	102 54
April 19	River Street, Delray................	8-in. "	12 67
June 14	Front of No. 371 Bagg Street.......	24-in. "	73 94
June 14	Front of No. 380 Bagg Street........	24-in. "	114 16
			$1,827 21

STATEMENT OF LEAKS COMPLAINTS, FROM JAN. 1, 1900, TO JULY 1, 1901.

MONTHS.	LEAKS.			COMPLAINTS.				SHUT.				LET ON.			
	In Mains.	In Service Pipe.	False Reports	No Water.	Bad Water.	Short Supply	Water Running.	Vacant	Non-payment.	For Leak.	Miscellaneous	Vacant Re-occupied.	Non-payment.	New.	Miscellaneous
January	3	133	16	8	9	8	3	15	13	80	6	3	2	2	5
February	8	140	24	3	5	4	9	7	20	210	......	8	3	......	1
March	15	85	33	12	1	6	1	3	7	86	2	12	2	1	3
April	17	110	15	49	9	13	1	3	26	70	3	9	3	1	11
May	12	67	12	19	7	7	3	1	16	42	1	8	......	......	10
June	5	66	11	13	15	13	1	2	2	26	1	9	......	3	4
July	4	49	10	6	22	6	4	1	2	12	3	......	1	1	4
August	4	45	8	6	14	13	......	......	16	20	......	4	3	2	3
September	11	57	4	5	4	16	1	......	2	19	4	3	4	2	1
October	9	31	4	2	4	3	1	1	8	15	5	2	......	......	2
November	6	24	5	7	5	8	......	1	12	28	8	4	4	2	2
December	13	44	14	13	10	5	......	......	1	52	1	1	....	1	5
Total	107	851	156	143	105	102	24	34	125	660	34	63	22	15	51

PIPE LAID FROM JANUARY 1st, 1900, TO JULY 1st, 1901.

Date.	LOCATION OF PIPE.	Feet	Size.	COST OF CONSTRUCTION.												
				Pipe.	Advertising.	Specials.	Lead.	Gates.		Sundries.	Gate-wells.	Hauling.	Repaving	Sup. & Eng.	Labor.	Total Cost.
								No.	Cost.							
May 11, 1901	Amsterdam st., from 7 ft. w. of e. of Cass to 22 ft. w. of w. of Cass....	108' 6"	6 in.	$ 38 64	....	$ 18 21	$ 8 92	2	$ 30 00	$ 5 42	$ 14 28	$ 5 25	....	$ 5 43	$ 112 24	$ 238 39
J'ne 17, 1900	Andrain st, (Springwells) e. from Morton. (also lowered 109 ft. of 4 in.).	21	4 in.	6 03	....	......	2 60	....	....	62	....	3 50	....	1 05	42 46	55 26
May 22, 1900	Ash st., from 34 ft. e. of w. of Fourteenth to 23 ft. e. of e. of Alley e. of same........................ ...	234	4 in.	65 08	....	6 19	7 80	....	6 50	1 43	25 33	7 00	....	11 70	121 88	252 24
May 14, 1901	Baldwin ave., s. of Mack—Blow off..	8	6 in.	5 73	.. ....	4 96	1 25	....	....	2 08	....	2 50	....	....	18 23	29 75
May 1, 1900	Belvedere ave., from 21 ft. n. of s. of Gratiot to 10 ft. s. of n. same......	41	6 in.	19 79	....	6 92	5 20	....	......	45	....	3 00	....	2 05	35 80	73 21
May 31, 1901	Bohemian st., from 35 ft. e. of w. of Cass to 4 ft. w. of w. of same......	39	6 in.	13 89	....	5 88	3 45	1	15 00	38	20 57	1 75	......	1 95	31 56	94 43
J'ne 28, 1901	Brekenridge st., from 28 ft. w. of e. of Twenty-third to 24 ft. w. of e. of Tillman........................	407	6 in.	215 28 144 98	....	10 42	16 10	....	15 00	1 55	21 19	7 00	....	20 35	109 72	346 26
Apr. 22, 1901	Cameron ave., from 21 ft. n. of Koch to 27 ft. s. of n. of Philadelphia....	897	6 in.	366 34	....	20 65	36 60	....	15 00	3 50	20 45	17 87	....	44 85	242 53	767 79
Apr. 24, 1900	Chippewa st., from 6 ft. s. of n. of Gratiot to 12 ft. n. of s. of same. .	64	6 in.	30 32	....	13 98	6 50	....	....	50	......	3 50	....	3 20	51 08	109 08
Dec. 8, 1900	Cicotte st., (Delray) from 22 ft. s. of n. of River st. to 229 ft. n. of same	254	4 in.	63 04	....	9 71	10 00	2	16 20	30	19 05	3 50	....	12 70	54 38	189 88
May 10, 1900	Clark ave., at alley s. of Michigan connecting 4 in. and 6 in. pipes....	4 2	4 in. 6 in.	1 81	....	9 67	3 80	....	....	1 46	....	3 50	....	30	24 36	45 00
J'ne 6, 1901	Colburn Place, from 35 ft. e. of w. of Cass to 35 ft. e. of e. of Second.	568' 6"	6 in.	233 10	....	9 45	18 68	....	15 00	3 09	28 57	7 00	....	28 40	160 57	508 81
J'ne 27, 1901	Colby st., from 4 ft e. of e. of Russell to 401 ft. e. of e. of same......	297	6 in.	105 80	....	7 00	9 77	....	8 00	1 02	26 19	7 00	....	14 85	72 12	246 75
J'ne 26, 1900	Congress st., from 25 ft. w. of e. of Van Dyke to w. line Maxwell. .	559	6 in.	273 63	....	11 86	29 70	2	24 00	1 34	24 47	11 00	....	27 95	117 20	521 15
May 4, 1900	Crane ave, from 22 ft. n. of s. of Gratiot to 8 ft. s. of n. of same....	56	6 in.	26 59	... .	3 34	3 90	....	....	48	....	3 00	....	2 24	48 00	87 55
J'ne 24, 1900	Dequindre and Milwaukee, for private connections	28	4 in.	6 70	....	5 60	1 75	....	7 00	23	31 72	1 50	13 20	1 40	18 24	87 34
J'ne 27, 1901	Dumontier, from end of pipes from 133 ft. w. of w. of Holcomb to 29 ft. w. of e. of same	164	6 in.	58 45	. ...	....	4 37	....	15 00	47	20 09	3 50	....	8 20	26 95	137 08

PIPE LAID FROM JANUARY 1st, 1900, TO JULY 1st, 1901—CONTINUED.

Date.	LOCATION OF PIPE.	Feet	Size.	COST OF CONSTRUCTION.												
				Pipe.	Advertising.	Specials.	Lead.	Gates.		Sundries.	Gatewells.	Hauling.	Repaving	Sup. & Eng.	Labor.	Total Cost.
								No.	Cost.							
Aug. 3, 1900	Durand st., from 28 ft. w. of e. of Van Dyke to 16 ft. w. of e. of same.	12	6 in.	$ 5 85	....	$ 46	$ 70	....	......	$ 05	....	$ 1 00	....	$ 60	$ 10 20	$ 18 86
June 17, 1901	Ellery st., from 25 ft. n. of s. of Hancock to 209 ft. n. of same.....	293	6 in.	104 38	....	15 39	11 96	2	$ 23 10	1 90	$ 23 76	10 50	....	14 65	34 35	239 99
Aug. 13, 1900	Euclid ave., from 11 ft. n. of s. of to 12 ft. s. of n. (130 ft. w. of 2nd st) .	37	4 in.	10 77	......	5 71	2 60	....	....	22	....	1 50	....	1 85	17 98	40 63
Aug. 11, 1900	Euclid ave., from 15 ft. n. of s. of to 10 ft. s. of n. (at 675 ft. e. of Hamilton Boulevard.)	34	4 in.	8 91	......	7 14	2 60	....	....	22	....	1 50	....	1 70	18 42	40 49
June 5, 1901	Farnsworth st., from 34 ft. w. of e. of Ellery to West line Mt. Elliott..	753	6 in.	308 81	....	2 03	25 40	....	15 00	3 35	18 21	8 50	....	37 65	198 42	617 37
June 15, 1901	Field ave. from 176 ft. n. of Medbury to 288 ft. n. of n. of same..........	122	6 in.	54 13	....	....	3 40	....	....	31	....	3 50	....	6 10	21 48	88 92
Sept. 20, 1900	Fifteenth st., from 30 ft. s. of n. of Harper to 11 ft. s. of n. of same...	19	6 in.	9 12	......	1 91	1 25	....	....	08	......	1 00	....	95	3 99	18 30
May 3, 1900	Fisher ave., from 21 ft. n. of s. of Gratiot to 10 ft. s. of n. of same...	50	6 in.	23 33	....	3 34	3 90	....	....	48	....	3 00	......	2 50	52 75	89 30
June 24, 1901	Gregorie ave., from e. line of Mc Clellan to 247 ft. e. of same........	247	6 in.	87 93	....	7 68	8 51	2	23 10	86	20 48	3 75	... ...	....	63 69	216 00
July 25, 1900	Griffin Car Wheel Co...............	130	6 in.													
June 13, 1900	Hamilton Boulevard, from 2 ft. s. of n. of Pallister to 29 ft. s. of n. of same........................	303 53	4 in. 6 in.	150 42 25 85	....	125 03 2 66	20 40 3 90	....	15 00 ....,..	3 49 26	28 39	6 75 2 50	....	21 65 2 65	84 93 13 99	455 97 51 81
June 20, 1901	Hanover st. from 4 ft. e. of e. line of Russell to 400 ft. e. of same.......	296	6 in.	105 63	......	3 94	9 77	....	8 10	1 02	21 15	7 00	....	14 80	72 12	243 53
Oct. 15, 1900	Hancock ave., from e. line of Maybury to 120 ft e. of same	120	6 in.	56 64	....	3 18	5 00	2	24 00	37	....	3 00	....	6 00	19 37	117 56
Apr. 26, 1900	Harper ave., from 21 ft. n. of s. of Gratiot to 9 ft. s. of n. of same....	40	6 in.	18 85	....	5 87	3 90	....	....	48	....	3 00	....	2 00	32 49	66 59
June 17, 1901	Hobart ave., from 305 ft n. of n. of Stanley to 1008 ft. n. of n. line same.	703	6 in.	250 44	....	5 17	27 37	. ..	....	2 82	....	8 75	....	35 15	162 96	492 66
June 29, 1901	Holcomb ave., from 16 ft. n. of s. line of Dumontier to 22 ft. n. of s. of Kolb.........................	425	6 in.	151 40	....	10 27	15 78	....	....	1 26	. .....	7 00	....	21 25	28 82	235 73
Aug. 2, 1900	Kercheval ave., crossing Van Dyke.	41	8 in.	26 32	....	8 72	4 50	...	....	47	....	1 00	....	2 05	14 00	57 06

May 9, 1901	Kercheval ave., (Delray) from 18 ft. s. of Wabash R. R. to 471 ft. south of same	461	6 in.	191 69		10 27	21 00			1 76		13 00		28 05	71 88	339 53
Sept. 27, 1900	Kirby ave., from 2 ft. w. of e. of St. Aubin to 269 ft. w. of same	272	6 in.	130 08		9 13	12 50	2	24 00	1 05	24 77	3 00	2 58	13 60	98 69	319 40
June 29, 1901	Koib st., from end of pipe 104 ft. w. of Holcomb to 25 ft. e. of w. same	135	6 in.	48 09		3 42	3 45		15 00	26	20 24	2 95		8 75	20 81	122 97
May 30, 1901	La Forest ave., from e. line of Nicollotte to e. line of Eighteenth (Hecker sub. of La Salle Gardens	255	6 in.	106 41		2 86	12 75		15 00	1 23	21 57	7 00		15 75	71 59	254 16
Oct. 27, 1900	Leland st., from 103 ft. w. of alley w. of Moran to 352 ft. w. of same	250	6 in.	120 00		1 61	10 00			43		2 50		12 50	37 10	184 14
Apr. 20, 1900	Maxwell ave., from 26 ft. n. of s. of Gratiot to 11 ft. n. of s. of same	42	6 in.	19 95		3 84	2 60			35		3 00		2 10	26 10	57 44
Apr. 28, 1900	May ave., from 22 ft. n. of s. of Gratiot to 9 ft. n. of s. of same	42	6 in.	19 56		6 92	5 20			30		3 00		2 10	34 46	71 54
Dec. 15, 1900	Medbury ave., from 25 ft. w. of e. of Van Dyke to 537 ft. e. of same	562	4 in.	139 03		10 84	20 00	2	16 20	2 60	19 78	5 25		28 10	122 74	364 54
Apr. 29, 1901	Melbourne ave., from 25 ft. e. of w. of Cameron to 394 ft. w. of w. same	419	6 in.	174 54		4 92	16 40		15 00	1 21	19 15	7 56		20 95	95 77	355 50
July 29, 1900	Merrick ave., at alley w. of Stanton	54	4 in.	15 39		4 61	2 50			11	22 53	1 75		2 70	18 95	68 54
June 20, 1901	McBrearty Pl., from 15 ft. w. of e. of Rivard to 9 ft. w. of e. of alley w. of Russell	273	4 in.	60 24		8 86	6 44	2	17 10	2 77	21 13	2 95		13 65	64 61	197 75
Sept. 24. 1900	McDougall ave., from 20 ft. s. of n. of Theodore to 93 ft. s. of same	123	6 in.	59 04			7 50			45		1 71		6 15	33 07	107 92
May 8, 1900	Newland ave., from 21 ft. n. of s. of Gratiot to 9 ft. n. of s. of same	12	6 in.	5 66		6 92	2 60			84		3 50		60	9 42	29 54
May. 28, 1900	Pallister and Woodward, (Con.)	6	4 in.	1 72								1 00		30	1 94	4 96
May. 28, 1900	Pallister ave., from 3 ft. e. of w. of Woodward to 4 ft. w. of e. Hamilton Boulevard	2,601	4 in.	745 20		10 33	68 90	3	27 00	4 52	71 32	10 50		130 05	505 81	1573 63
Sept. 18, 1900	Pennsylvania ave., from 1612 ft. n. of n. of Kercheval to 1915 ft. n. of same	306	6 in.	145 92		81	12 25			75		7 00		15 30	57 11	239 14
May. 6, 1901	Parker ave., from Tonti to Champlain	584	6 in.	240 28		971	24 65		15 00	2 91	20 43	11 20		29 20	167 28	520 66
May. 11, 1900	Private property, s. of Michigan bet. Scotten and Clark	559	8 in.	364 75		15 40	28 60		13 75	3 80	28 18	11 50		27 95	231 03	724 96
May. 6, 1901	Pumping Station,	9	2 in.	1 80		2 20	81	Meter	55 00 3 75	05	29 46				3 69	96 76
Oct. 22, 1900	Rademacher, (Delray) from 21 ft. s. of n. of River st. to 689 ft. n. of same	709	6 in.	293 80		14 58	28 75		15 00	2 25		10 00		35 45	160 71	560 54

PIPE LAID FROM JANUARY 1st, 1900, TO JULY 1st, 1901—CONTINUED.

Date.	LOCATION OF PIPE.	Feet	Size.	COST OF CONSTRUCTION.												
				Pipe.	Advertising.	Specials.	Lead.	Gates. No.	Gates. Cost.	Sundries.	Gate-wells.	Hauling.	Re-paving	Sup. & Eng.	Labor.	Total Cost.
Apr. 28, 1900	Seneca ave., from 11 ft. s. of n. of Gratiot to 15 ft. n. of s. of same	62	6 in.	$28 78		$13 98	$5 20			$ 58		$3 00		$3 10	$49 62	$104 21
Feb. 26, 1901	Sidney ave., from 25 ft. e. of w. of Cameron to 309 ft. w. of w. same.	334	6 in.	138 90		4 91	12 00		$15 00	1 31	$19 15	6 57		16 65	71 11	285 60
June 25, 1901	Sixteenth st., from 25 ft. s. of n. line of McGraw to 685 ft. n. of n. same.	710	6 in.	252 92		6 80	26 22		8 10	1 90	19 60			12 25	192 84	520 63
Apr. 21, 1900	Stephens ave., from 25 ft. n. of s. of Gratiot to 13 ft. n. of s. of same	14	6 in.	6 60		3 34	1 30			13		1 50		70	14 65	28 22
Nov. 5, 1900	Sylvester ave., (Private property) from 5 ft. e. of center of Belvedere to 876 ft. w. of same	876	42 in.	5,846 03			320 00			108 84		300 05		43 80	2,418 02	9,036 74
Nov. 14, 1900	Thirty-third st., from 35 ft. s. of n of Horatio to 245 ft. n. of same	280	6 in.	103 96		6 61	12 50	2	24 00	98	20 44	2 25		14 00	72 70	257 44
Oct. 17, 1900	Thirtieth st., from 42 ft.. s. of n. of Visger to 120 ft, n. of n. of same.	163	6 in.	76 80		1 15	7 50		15 00	67	20 24	3 00		8 15	31 08	163 59
May. 8, 1900	Thurman ave., from 10 ft. n. of s. of Gratiot to 6 ft. s. of n. of same	60	6 in.	28 27		3 87	2 60			5 68		3 50		3 00	28 02	74 94
Dec. 11, 1900	Trumbull alley e. of, from 6 ft. s. of n. of Ash to 73 ft. n. of same. (Private)	85	6 in.	35 22		11 68	3 70			53		3 00		4 25	48 79	107 17
June 3, 1901	Vienna st., from 35 ft. e. of w. to 3 ft. e. of e. of same	49	6 in.	17 16		5 88	3 50		15 00	1 02	17 61	3 75		2 45	38 50	104 87
Nov. 26, 1900	Washington, alley w. of n. of Clifford lowered 245 ft. 4 in.	43	4 in.	14 24		28 31	7 50		8 10	6 65	19 90	10 35	$17 50	2 15	180 62	295 32
Dec. 18, 1900	Wesson ave., n. of Herbert for blow off connection	5	4 in.	1 30		7 78			15 00	21		1 00		25	17 03	42 54
Oct. 26, 1900	Wight st., (Delray) from 678 ft. n. of River st., to 737 ft. n. of same.	61	6 in.	25 28		2 29	2 00	1	9 00	19		1 88		3 05	13 66	57 35
Dec. 11, 1900	Wight st. (Delray) 5rom 737 ft. n. of River st., to 785 ft. n. of same	49	6 in.	20 09			3 00			20		2 50		2 43	13 65	41 87
June 4, 1901	Willis ave., from w. of w. line of alley w. of Mt. Elliott to 6 ft. e. of w. line of same and alley w. of Mt. Elliott from 19 ft. n. of s. line of Willis to 21 ft s. of n. line of Superior, and Superior from 3 ft. e. of w. line of alley w. of Mt. Elliott to 1 ft. w. of w. line of same.	16 52 4	4 in. 4 in. 4 in.	67 39		7 50	8 50			1 10	20 82	7 75		13 60	68 95	195 61

June 2, 1900	Woodward ave., from 2 ft. s. of n. of Pallister to 47 ft. n. of same....	49	4 in.	14 00	....	1 70	2 60		9 00	21	24 48	5 50	....	2 45	8 97	68 91
Oct. 30, 1900	Woodward ave., (Grade crossing) relaid 425 ft. 10 in. pipe............	37	10 in.	27 19	....	49 97	15 60	2	24 00	1 45	20 44	7 00	....	23 10	376 42	547 17
Jan. 22, 1901	Hydrant connection (Delray)........	12	6 in.	4 97	....	6 81	3 75	...	....	48	....	1 25	....	....	14 11	31 37
Jan. 28, 1901	Hydrant connection (Delray)..	12	6 in.	4 97	....	4 77	3 75	...	....	48	....	1 25	....	....	14 11	29 33
June 1900	Daniels Brick Yard, (Springwells) lowered..........................	109	4 in.	....	....	....	....	...	....	....	....	....	....	....	....	56 26
Dec. 1900	Washington alley, west of east of Clifford, lowered 265 ft. and laid 33 ft..........................	....	....	....	....	......	....	...	....	....	....	....	....	....	....	295 32
1900	Knights of Pythias encampment, • temporary pipe laid at grounds...	....	....	....	......	....	....	...	....	....	....	....	....	....	....	483 19

All of which is respectfully submitted,

LUKE CROSSLEY,

Superintendent of Construction.

SUPPLEMENT.

BOARD OF MANAGEMENT OF DETROIT WATER WORKS

Board of Trustees appointed by Common Council, February 24th, 1852; organized March 1st, 1852.

Shubael Conant, Chairman.
Edmund A. Brush.
Henry Ledyard.
Wm. R. Noyes.
Jas. A. Van Dyke.

1853

On the 16th of May, 1853, the Board of Water Commissioners of the City of Detroit was organized under an act previously approved by the Common Council and passed by the Legislature, February 14th, 1853. The term of service was determined by lot, as follows:

Jas. A. Van Dyke,	for 3 years.
Edmund A. Brush,	for 4 years.
Henry Ledyard,	for 5 years.
Shubael Conant,	for 6 years.
Wm. R. Noyes,	for 7 years.

Shubael Conant was elected President, who, finding the duties too arduous, resigned July 30th, and Edmund A. Brush was elected.

1854

Edmund A. Brush, President.
Jas. A. Van Dyke.
Shubael Conant.
Wm. R. Noyes.
Henry Ledyard.

1855.

Edmund A. Brush, President.
Henry Ledyard.
Shubael Conant.
William R. Noyes.
James A. Van Dyke, died May 8th.
A. D. Fraser, appointed to fill vacancy.

1856.

Edmund A. Brush, President.
Shubael Conant.
Wm. R. Noyes.
Alexander D. Fraser, re-appointed May 1st, for 5 years.
Henry Ledyard.

1857.

Edmund A. Brush, President, re-appointed May 1st, for 5 years.
Henry Ledyard.
Alexander D. Fraser.
William R. Noyes.
Shubael Conant.

1858.

Edmund A. Brush, President.
Shubael Conant.
Alexander D. Fraser.
Henry Ledyard, re-appointed May 1st, for 5 years.
Wm. R. Noyes.

1859.

Edmund A. Brush, President..
Alexander D. Fraser.
Wm. R. Noyes.
Shubael Conant, term expired May 1st, and
Julius D. Morton, appointed for 5 years.
Henry Ledyard, vacated by moval from city, and
John V. Ruehle, appointed May 1st to fill vacancy.

1860.

Edmund A. Brush, President.
Alexander D. Fraser.
Julius D. Morton.
William R. Noyes, re-appointed May 1st, for 5 years.
John V. Ruehle.

1861.

Edmund A. Brush, President.
Alexander D. Fraser, re-appointed May 1st for 5 years.
Jno. V. Ruehle, resigned Sept. 16th, and
Chauncey Hurlbut appointed to fill vacancy.

1862.

Edmund A. Brush, President, re-appointed May 1st, for 5 years.
Wm. R. Noyes.
Julius D. Morton.
Chauncey Hurlbut.
Alexander D. Frazer.

1863.

Edmund A. Brush, President.
Alexander D. Frazer.
Wm. R. Noyes.
Julius D. Morton.
Chauncey Hurlbut, term expired May 1st, and
Stanley G. Wight, appointed for 5 years.

1864.

Edmund A. Brush, President.
Alexander D. Frazer.
Wm. R. Noyes.
Julius D. Morton, term expired May 1st.
Stanley G. Wight.

1865.

Edmund A. Brush, President.
Wm. R. Noyes, resigned Jan. 10, and Jacob S. Farrand appointed to fill vacancy, Term expired May 1st. Re-appointed for 5 years.
Alexander D. Frazer.
Stanley G. Wight.
Julius D. Morton, re-appointed for 5 years from May 1st, 1864. Died Feb. 1865, and Jno. Owen appointed to fill vacancy.

1866.

Edmund A. Brush, President.
Alexander D. Fraser, re-appointed May 1, for 5 years.
Stanley G. Wight.
Jacob S. Farrand.
Jno. Owen.

1867.

Edmund A. Brush, President, re-appointed May 1, for 5 years.
Alexander D. Fraser.
Jacob S. Farrand.
Jno. Owen.
Stanley G. Wight.

1868.

*Edmund A. Brush, President.
Stanley G. Wight, term expired May 1, and
Chauncey Hurlbut appointed for 5 years.
Jacob S. Farrand.
John Owen.
Caleb Van Husan.

*Edmund A. Brush resigned January 28, and Caleb Van Husan appointed to fill vacancy, and Alexander D. Fraser elected President.

1869.

Alexander D. Fraser, President.
John Owen, re-appointed May 1, for 5 years.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.

1870.

Alex. D. Fraser, President.
Jacob S. Farrand, re-appointed May 1, for 5 years.
Jno. Owen.
Caleb Van Husan.
Chauncey Hurlbut.

1871.

*Alex. D. Fraser, President.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.
John Owen.

*Term expired May 1, and Samuel F. Hodge appointed for 5 years. Jacob S. Farrand elected President.

1872.

Jacob S. Farrand, President.
Jno. Owen.
*Caleb Van Husan.
Samuel F. Hodge.
Chauncey Hurlbut.

*Term expired May 1st, and Elija Smith appointed for 5 years.

1873.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed. Elected President, May, 1872.

1874.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re.appointed.

1875.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1876.

Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. *Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1877.

Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
*Michael Martz.

*Elija Smith's term expired and Michael Martz appointed to fill vacancy.

1878.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Michael Martz.

*Term expired and re-appointed.

1879.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
*Jno. Pridgeon.

*Jno. Owen's term expired and John Pridgeon appointed to fill vacancy. Samuel F. Hodge resigned and Jas. Beatty appointed to fill vacancy.

1880.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1881.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1882.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1883.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1884.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
*Jno. Pridgeon.

*Term expired, and Marshall H. Godfrey appointed

1885.

*Jacob S. Farrand, President. Michael Martz.
Marshall H. Godfrey. *Edwin F. Conely.
*Samuel G. Caskey.

*Jas. Beatty died and Edwin F. Conely appointed to fill vacancy.
*Chauncey Hurlbut died and Samuel G. Caskey appointed to fill vacancy.
*Jacob S. Farrand's term expired and re-appointed.

1886.

Jacob S. Farrand, President. Michael Martz.
Marshall H. Godfrey. *Jno. Pridgeon.
Samuel G. Caskey.

*Edwin F. Conely's term expired and Jno. Pridgeon appointed to fill vacancy.

1887.

Jacob S. Farrand, President. Jno. Pridgeon.
Marshall H. Godfrey. Samuel G. Caskey.
*Joseph Nagel.

*Michael Martz term expired and Joseph Nagel appointed to fill vacancy.

1888.

Jacob S. Farrand, President. Jno. Pridgeon.
Marshall H. Godfrey. *Samuel G. Caskey.
Joseph Nagel.

*Term expired and re-appointed.

1889.

Jacob S. Farrand, President. Jno. Pridgeon.
Samuel G. Caskey. Jos. Nagel.
*August Goebel.

*Marshall H. Godfrey resigned January 1, 1889. August Goebel appointed to fill vacancy. Term expired May 1st, and re-appointed.

1890.

Jno. Pridgeon, President. August Goebel.
Joseph Nagel. *Henry M. Duffield.
Samuel G. Caskey.

*Jacob S. Farrand's term expired, and Col. Duffield was appointed to fill vacancy July 9th, 1890; John Pridgeon resigned as President of the Board, on account of ill-health, and Henry M. Duffield was elected to fill vacancy.

1891.

Henry M. Duffield, President. *Jno. Pridgeon.
August Goebel. Samuel G. Caskey.
Joseph L. Hudson.

*John Pridgeon's term expired May 1st, and Frank E. Kirby was appointed for a term of 5 years.

1892.

Samuel G. Caskey, President. Henry M. Duffield.
August Goebel. Joseph L. Hudson.
Frank E. Kirby.

1893.

August Goebel, President. Samuel G. Caskey.
Frank E. Kirby. Henry M. Duffield.
Joseph L. Hudson.

1894.

Henry M. Duffield, President. Frank E. Kirby.
Albert L. Stephens. De Witt H. Moreland.
Edward W. Pendleton.

A. L. Stephens appointed to succeed J. L. Hudson.
D. W. H. Moreland appointed to succeed S. G. Caskey.
Clarence A. Black appointed to succeed August Goebel.
C. A. Black resigned and E. W. Pendleton appointed to succeed him from Dec, 1.

1895.

Frank E. Kirby, President. Albert L. Stephens.
DeWitt H. Moreland. Edward W. Pendleton.
Darius D. Thorp.

1896.

Albert L. Stephens, President.
Edward W. Pendleton.
John P. Huckestein.
Darius D. Thorp.
John W. McGrath.

D. W. H. Moreland resigned to accept Commissionership on Board of Public Works, and J. P. Huckestein was appointed to fill vacancy.

Frank E. Kirby's term expired and J. W. McGrath was appointed to succeed him.

1897.

Edward W. Pendleton, President.
Darius D. Thorp.
James W. Millen.
John W. McGrath.
August Goebel.

August Goebel, appointed to succeed A. L. Stephens. Resigned January 1, 1898, and Joseph J. Noeker was appointed to fill vacancy.

John P. Huckestein resigned and James W. Millen was appointed to fill vacancy

1898.

Edward W. Pendleton, President.
Joseph J. Noeker.
John W. McGrath.
Darius D. Thorp.
James Meathe.

1899.

Darius D. Thorp, President.
John W. McGrath.
Joseph J. Noeker.
*James Meathe.
Edward W. Pendleton.

*James Meathe died September 21st, 1899, and Benjamin Guiney was appointed to fill vacancy.

1900.

John W. McGrath, President.
Joseph J. Noeker.
*Benjamin Guiney.
Edward W. Pendleton.
Darius D. Thorp.

Benjamin Guiney resigned, and John Zynda was appointed to fill vacancy.

1901.

Joseph J. Noeker, President.
John Zynda.
Edward W. Pendleton.
Darius D. Thorp.
Joseph J. Crowley.

Engineering Library Annex
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FORTY-EIGHTH
ANNUAL REPORT
OF THE
BOARD OF WATER COMMISSIONERS

WATER WORKS

TO THE
COMMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR
1899.

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THE BOARD OF WATE

CITY OF

METER

First 10,000 gals..................
All over 10,000 gals...........
Minimum Rate.................

Payable Quar

ASSESS

For Family, household purposes
Additional Families to first
each.... ....
Green Houses.—Special rate
Private Stable, for each horse
Livery Stables, " "
Dray and Team Horses, each
Cows, each......... ....
Stores and Offices, from...
Bakeries, average daily use
Saloons, Groceries and Private
Bar, with faucet, from.....
Fish Houses............
Slaughter Houses.—Special
Hotels and Taverns,
Boarding Schools, from
Building Purposes, each
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BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT FOR 1899.

MEMBERS:

DARIUS D. THORP, 1900.
JOHN W. McGRATH, 1901.
JOSEPH J. NOEKER, 1902.
BENJAMIN GUINEY, 1903.
EDWARD W. PENDLETON, 1904.

COMMITTEES:

WAYS AND MEANS	Commissioners PENDLETON, NOEKER.
EXTENSION AND CONSTRUCTION,	Commissioners McGRATH, GUINEY.
PUMPING WORKS	Commissioners NOEKER, McGRATH.
SUPPLIES	Commissioners GUINEY, PENDLETON.

The President is ex-officio member of each committee.

OFFICERS:

PRESIDENT	DARIUS D. THORP.
VICE-PRESIDENT	JOHN W. McGRATH.
GENERAL MANAGER	MARSHALL H. GODFREY.
SECRETARY	H. S. STARKEY.
SUPERINTENDENT OF CONSTRUCTION	LUKE CROSSLEY.
SUPT. OF METERS AND INSPECTION	THOMAS R. PUTNAM.
CIVIL ENGINEER	C. W. HUBBELL.
CHIEF ENGINEER AT PUMPING WORKS	URIAH GOULD.
RECEIVING CLERK	GEORGE E. KUNZE.
CASHIER	H. J. A. LETEKER.
ASSISTANT CASHIER	S. G. ROOD.
METER CLERK	FRED. H. HUTAFF.
BOOKKEEPER	ARTHUR V. POTTER.
PERMIT CLERK	ARTHUR J. STORM.
COLLECTORS	FRANK PETZ. T. W. GOODALE. W. W. WILCOX. ANTHONY VOGEL. J. J. ROBINSON. GEORGE ADAMS. M. A. DETTLING. CHARLES M. PRESTON.
STORE KEEPER	WM. A. BOURKE.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

To the Honorable the Common Cauncil of the City of Detroit

The Board of Water Commissioners of the City of Detroit, in compliance with law, respectfully submits its annua report for the year ending December 31, 1899.

The financial transactions, work of construction and th details of pumping water, are fully set forth in the report of the various heads of departments herewith transmitted and to which you are respectfully referred.

Since our last report, a member of the Board, Jame Meathe, has died. Resolutions expressing regret and a high appreciation of his merits were placed upon the records o this department.

The total receipts for the year were $303,910.42, o which the sum of $257,411.97 was received from water rates The total expenditures for the year were $347,328.77, o which the sum of $157,158.06 was expended for construction, $119,946.32 for operation and maintenance, $66,969.1 for interest, and $3,255.24 under the Hurlbut will.

The total number of families on the assessment roll July 1, 1899, was 58,931. There were but 174 families in the city unsupplied.

Arrangements were made to refund $100,000 of bonds which became due September 1, and the bonded indebtedness of the Board remains the same as at the beginning of the year. The amount is $1,033,000.

The total pipeage of the distribution system December 31, 1899, was 560 miles and 1,957 feet, of which 7 miles and 1,878 feet were laid during the year.

The quantity of water pumped during the year was 16,348,062,701 gallons, the largest quantity that has been pumped in any year in the history of the Board, and an increase over the previous year of 2,069,380,643 gallons. The average delivered daily was 44,789,212 gallons.

Four water tube boilers were contracted for the past year, to take the place of the four old marine boilers in the east end of boiler room, and at a cost of $13,977.00. They are now in place and will soon be in commission.

The care of the Hurlbut Memorial Library has been placed in the hands of the Detroit Library Commission, who have established there a branch of the public library. The attractive features of the Water Works Park, and the large increase of population in its vicinity, has made this a most favorable opportunity for the introduction of branch libraries in our city. This library is being largely patronized.

During the past two years there has been expended, for permanent improvements at the Water Works Park, the sum of $43,324.82, as follows: Hurlbut Memorial Library Building, $9,174.65; lavatories on west side of grounds, $3,073.46; lavatories in gateway, $1,470.80; greenhouse, $5,759.61; electric light conduits, cables and wiring, $3,069.37; sewage, drainage and sprinkling system, $6,671.17; conduit between engines 2 and 3, $2,123.36; foot and carriage bridges, $4,426.00; underpinning engine No. 2, $287.96.

The rapid growth of the city and the additional burdens placed on the pumping department, make a necessity for the enlargement and extension of the system to meet these demands, especially for sufficiently supplying the northern portion of the city. It is necessary that the construction of high pressure system should be immediately commenced supply this section. To complete this work will necessari take several years. A large expense must be incurred in tl construction of necessary mains, addition to pumping hou and engines. As this will require a larger amount of mon than the Board will receive from its ordinary resources, is the intention to request the Legislature, at its next sessio to authorize the issue of sufficient amount of bonds to cov such portion of the expense of construction as may be ne essary.

In carrying out these necessary extensions, we sha earnestly endeavor that all our expenditures and metho shall be economical and judicious.

All of which is respectfully submitted.

DARIUS D. THORP,
JOHN W. McGRATH,
JOSEPH J. NOEKER,
BENJAMIN GUINEY,
EDWARD W. PENDLETON,

Board of Water Commissioners of the City of Detroit.

HURLBUT MEMORIAL GATE
OUTSIDE
WATER WORKS
PARK
WATER WORKS
AND TOWER
HURLBUT MEMORIAL GATE
INSIDE

FORTY-EIGHTH ANNUAL REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE CITY OF DETROIT

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1899.

DETROIT FREE PRESS PRINTING COMPANY.
1900.

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Report of the Superintendent of Grounds......................... 72

Supplement.. 75

Percentage Account.—		
Labor	$ 4,897 70	
		$ 4,897 70
Total operation and maintenance		$119,946 32
Hurlbut Fund Account.—		
Labor	$ 1,567 00	
Library	1,071 73	
Tools and repairs	213 73	
Librarians	157 50	
Repairing gate	80 45	
Sod	50 00	
Paint, oils, etc	35 06	
Lumber	34 07	
Flower pots	20 55	
Plants	9 00	
Horseshoeing	8 15	
Subscriptions to papers	8 00	
		$ 3,255 24
Interest Account.—		
Interest paid	$ 66,969 15	
		$ 66,969 15
Total expenditures		$347,328 77

RECAPITULATION OF EXPENDITURES.

Construction expenses	$157,158 06
Operation and maintenance	119,946 32
Hurlbut fund	3,255 24
Interest	66,969 15
Total expenditures	$347,328 77

The total receipts of the Receiving Clerk from January 1, 1899, to January 1, 1900, were as follows:

January	$ 51,341 30
February	8,117 07
March	11,567 93
April	43,101 28
May	10,477 96
June	19,482 42
July	58,252 28
August	9,193 98
September	17,333 25

October	$ 54,333 29	
November	10.938 45	
December	9,771 21	
	$303,910 42	
Cash on hand January 1, 1899	3,209 10	
		$307,119 52

With bank deposits as follows:

January	$ 49,326 11	
February	11,542 45	
March	10,637 33	
April	40,586 23	
May	14,051 68	
June	18,257 59	
July	54,892 49	
August	13,673 17	
September	15,695 68	
October	51,912 33	
November	15,071 27	
December	8,591 55	
	$304,237 88	
Cash balance January 1, 1900	2,881 64	
		$307,119 52

Cash Statement, Year, 1899.

January 1, 1899.		Dr.	
Cash on hand		$ 3,209 10	
American Exchange National Bank—			
Balance, general fund		19,784 61	
Balance, sinking fund		75,376 86	
Balance, Hurlbut fund		2,737 66	
Balance, secretary's fund		1,000 00	
Receipts, general	$301,910 42		
Transfer from Hurlbut fund, June 30, 1899	2,000 00		
		$303,910 42	
			$406,018 65
January 1, 1900.		Cr.	
Cash on hand		$ 2,881 64	
American Exchange National Bank—			
Balance, general fund	11,780 57		
Checks outstanding	1,732 68		
		$ 10,047 89	
Sinking fund		$ 42,734 16	
Hurlbut fund		26 19	
Secretary's fund	$ 1,334 00		
Checks outstanding	334 00		
		$ 1,000 00	
Transfer from Hurlbut fund, June 30, 1899		2,000 00	
Disbursements		347,328 77	
			$406,018 65

THE AMERICAN EXCHANGE NATIONAL BANK.

Detroit, January 2, 1900.

H. S. Starkey, Secretary Board of Water Commissioners, Detroit, Mich.:

Dear Sir — This is to certify that the amount of your General Account balance in this bank at close of business December 31, 1899, was $11,780.57; Sinking Fund was $42,734.16; Hurlbut Fund, $26.19.

Yours truly,

HAMILTON DEY,
Cashier.

The following table is the report of the assessment for the year commencing July 1, 1899.

ASSESSMENT 1899–1900.

Dist.	WARDS.	FAMILIES.			Increase.	Vacant Tenements.	ASSESSMENT.		
		Supplied.	Not Supplied.	Whole Number.			1899-1900.	Increase.	Transf'rd to Meter Rolls.
1	Ninth.......	5,672	14	5,686	250	159	$13,285 60	$564 60	......
	Fifteenth...	1,999	7	2,006	221	25	6,306 25	581 20	$ 4 35
	Seventeenth	1,974	18	1,992	123	42	6,853 70	875 75	......
	Totals ...	9,645	39	9,681	594	226	26,445 55	2,021 55	4 35
2	Eleventh ...	3,859	8	3,867	39	72	10,601 55	420 95	69 10
	Thirteenth..	3,040	....	3,040	158	28	8,974 05	848 25	6 00
	Totals ...	6,899	8	6,907	197	100	19,575 60	1,269 20	75 10
3	First........	2,931	1	2,932	128	68	14,395 80	776 45	30 20
	Seventh	3,512	8	3,520	101	37	8,606 75	521 30	38 60
	Totals....	6,443	9	6,452	229	105	23,002 55	1,297 75	68 80
4	Third.......	3,631	7	3,638	144	52	9,996 90	712 75	24 60
	Fifth........	4,108	13	4,121	107	36	10,814 80	884 05	37 60
	Totals ...	7,739	20	7,759	251	88	20,811 20	1,596 80	62 20
5	Second	2,317	3	2,320	53	83	14,347 60	*—3,483 95	......
	Sixth........	4,003	4	4,007	164	76	13,468 60	704 50	251 70
	Totals ...	6,320	7	6,327	217	159	27,816 20	*—2,779 45	251 70
6	Tenth.......	4,523	3	4,526	130	78	13,739 55	1,233 90	11 70
	Fourteenth.	2,739	11	2,750	141	63	8,153 20	1,010 55	10 20
	Totals ...	7,262	14	7,276	271	141	21,892 75	2,244 45	21 90
7	Fourth.. ...	3,646	5	3,651	402	73	13,658 45	994 70	84 20
	Twelfth	3.668	7	3,675	153	65	10,585 30	1,037 35	3 75
	Totals ...	7,314	12	7,326	555	138	24,243 75	2,032 05	87 95
8	Eighth......	3,772	3	3,775	46	106	12,589 60	594 80	......
	Sixteenth...	3,537	62	3,599	95	45	9,251 45	508 00	25 40
	Totals ...	7,309	65	7,374	141	151	21,841 05	1,102 80	25 40
	Aggregate	58,931	174	59,105	2,455	1,108	$185,628 65	$8.785 15	$597 40

* Decrease.

As shown in this table, July 1, 1899, there were 59,10 families in the City of Detroit. Using the same average pe family as in previous years, 5.14, the population of the cit at that time was 303,800, an increase over July 1, 1898, o 12,619.

The average used was obtained by taking the popula tion as shown by the United States Census of 1860-70-8 and 90, and dividing by the number of families on Assess ors' books for those years, as follows:

Years.	Population per census.	No. of families assessed.	Average.
1860	45,619	8,973	5.08
1870	79,757	14,717	5.42
1880	116,340	22,423	5.18
1890	205,876	42,059	4.80

Making the general average 5.14.

The following table shows the receipts for water rate during the year, arranged by districts, and giving the amoun collected upon each annual assessment:

RECEIPTS OF WATER RATES BY DISTRICTS.

YEARS.	1st District Wards 9, 15 and 17.	2d District, Wards 11 and 13.	3d District, Wards 1 and 7.	4th District, Wards 3 and 5.	5th District, Wards 2 and 6.	6th District, Wards 10 and 14.	7th District, Wards 4 and 12.	8th District, Wards 8 and 16.	Meters, Jan. 1, 1899, to Jan. 1, 1900.	Aggregate.
1888–9	....	$5 00	....	....	....	....	....	....	....	$5 00
1889–90	....	5 00	....	....	....	....	....	....	....	5 00
1892–3	....	....	....	....	....	$19 75	....	....	....	19 75
1893–4	....	....	....	....	....	18 00	....	....	....	18 00
1894–5	$2 50	....	$3 25	....	....	19 75	$2 50	....	....	28 00
1895–6	12 75	2 50	1 25	$1 25	....	19 50	....	....	....	37 25
1896–7	25	4 00	10 00	5 00	$5 00	71 00	17 50	$5 50	....	118 25
1897–8	16 31	18 38	47 22	7 44	48 54	135 49	24 90	15 60	....	313 88
1898–9	12,532 70	9,416 63	11,459 86	9,986 78	13,356 19	10,489 31	12,004 00	11,023 14	....	90,268 61
1899 } 1900 }	13,598 44	10,126 03	11,873 50	10,605 31	13,825 37	11,097 71	12,189 47	11,158 83	$72,123 35	166,598 01
Total..	$26,162 95	$19,577 54	$23,395 08	$20,605 78	$27,235 10	$21,870 51	$24,238 37	$22,203 07	$72,123 35	$257,411 75

Water Works Bonds.

The following table shows the whole history of the bond indebtedness of the Board, in which it will be seen that th total amount of bonds issued is $1,950,000, of which $917,0 have been redeemed, leaving outstanding $1,033,000. O these $100,000 became due, and by arrangement, payme thereof was deferred to February 1st, 1900.

No. of Issue.	Act of	Issued.	Payable.	Amount.	Rate of Interest.	Redeemed.	Out-standin
1st	1853	Aug. 1, 1853	Aug. 1, 1883	$100,000	7cts.	$100,000	....
"	"	" "	Aug. 1, 1878	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1873	50,000	7 "	50,000	....
2nd	1855	Aug. 1, 1855	Aug. 1, 1890	100,000	7 "	100,000	....
"	"	June 12, 1855	Aug. 1, 1885	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1880	50,000	7 "	50,000	....
3rd	1857	Aug. 1, 1858	Aug. 1, 1893	150,000	7 "	150,000	....
"	"	Aug. 1, 1867	Aug. 1, 1887	100,000	7 "	100,000	....
4th	1869	Feb. 1, 1870	Feb. 1, 1900	100,000	7 "	....	100,0
5th	"	Aug. 1, 1872	Aug. 1, 1902	50,000	7 "	....	50,0
6th	"	Aug. 1, 1873	Aug. 1, 1903	50,000	7 "	....	50,0
"	1873	Feb. 1, 1874	Feb. 1, 1904	50,000	7 "	9,000	41,0
7th	1869	Aug. 1, 1874	Aug. 1, 1904	50,000	7 "	6,000	44,0
"	1873	" "	" "	200,000	7 "	....	200,0
"	"	June 1, 1875	June 1, 1905	150,000	7 "	1,000	149,0
"	"	June 1, 1876	June 1, 1906	200,000	6 "	1,000	199,0
"	"	Sept. 1, 1880	Sept. 1, 1899	100,000	4 "	....	100,0
"	"	April 1, 1881	April 1, 1897	100,000	4 "	100,000	....
"	"	Dec. 1, 1881	Dec. 1, 1896	50,000	4 "	50,000	....
"	"	Jan. 10, 1895	Jan. 10, 1925	100,000	4 "	....	100,0
				$1,950,000		$917,000	$1,033,0

The amount expended for the Pumping Works to January 1st, 1900, is as follows:

ITEMS.	Previously Expended.	1899.	Total.
Land	$38,331 44	....	$38,331 44
Force Mains	624,058 03	....	624,058 03
Inlet Pipe	91,417 84	$5,885 56	97,303 40
Dock, Basin and Canal	148,291 60	210 65	148,502 25
Conduits and Wells	81,461 70	....	81,461 70
Engine, Boiler and Coal Houses	217,531 71	268 70	217,800 41
Stand Pipe and Tower	31,574 16	....	31,574 16
Pump Wells	54,221 56	....	54,221 56
Engines	359,338 87	....	359,338 87
Boilers	76,769 66	11,502 59	88,272 25
Engineer's House	8,139 75	....	8,139 75
Sewers	6,666 25	....	6,666 25
Electric Light Plant	718 49	2,062 70	2,781 19
Grounds, Fences and Gateway	145,014 47	8,547 55	153,562 02
Inspection	3,055 42	5 80	3,061 22
Miscellaneous	14,326 53	1,585 81	15,912 34
Library, Greenhouse and Belvedere	8,294 46	26,295 09	34,589 55
Totals	$1,909,211 94	$56,364 45	$1,965,576 39

Estimated Valuation of the Works.

Real estate	$ 441,871 75
Buildings, docks, basins, conduits, engines, etc., at pumping station	1,710.059 13
Water pipe in use	3,712,353 82
Meters in use	100,204 74
Office furniture and fixtures	16,000 00
Tools and materials on hand:	
In office of Supt. of Construction	146 00
In office of Civil Engineer	19,293 09
In Inspection Department	81 00
In Meter Department	2,472 68
In Pumping Works Department	19,450 44
In Hurlbut Fund Department	1,459 80
At storage grounds	37,717 82
Total	$6,061,110 27

All of which is respectfully submitted.

H. S. STARKEY,
Secretary.

REPORT OF THE GENERAL MANAGER.

Detroit, January 3, 1900.

To the Board of Water Commissioners of the City of Detroit:

Gentlemen—I respectfully submit a report of the general operations of the Works for the year ending December 31, 1899.

Storage Grounds.

A much needed improvement was made in replacing the old cobble stone pavement in the yard by a brick pavement, not only vastly improving the appearance of the yard and enabling it to be more easily kept in a cleanly condition, but also adding to the safety of the teams and drivers, several accidents having occurred on account of the condition of the old pavement. In connection with the paving, a system of drainage was instituted which will keep the grounds in a good condition.

The construction of a wagon wash shed was commenced and upon completion the wagons can be cared for with a great saving of time and labor.

Pumping Works.

Four new boilers were contracted for during the year, and are nearing completion. These are vertical safety water tube steam boilers of 225 horse-power capacity each, set in two batteries, of two boilers to each battery, and equipped with the Murphy smokeless furnaces. The water heating surface of each boiler is 2,466 square feet, and when using the class of coal now in use at the pumping station, the boilers are guaranteed to evaporate, from and at 212 degrees Fahr., ten pounds of water per pound of coal, and this evaporation to hold when each boiler is developing 225 horse power. These boilers are located in the east room, and replace the four old marine boilers.

September 4, shaft of Engine No. 1 broke and was replaced by Samuel F. Hodge & Co., at a cost of $1,240.00.

A conduit was built connecting Engines Nos. 2 and 3, and a sixty-inch valve, to control same, has been placed.

It became necessary to repair Inlet Pipe No. 2, and a contract was entered into with John S. Quinn & Co. for the taking up, repairing, cleaning, painting and relaying of seventeen lengths near the shore end of pipe in the Detroit River. This inlet pipe is six feet in diameter, built of boiler iron, three-eighths of an inch thick and riveted in sections twenty-six and one-half feet long, weighing about four and one-half tons each. The sections are joined by cone joints. which are drawn together with bolts. Seventeen lengths were taken up, removed to the bank, cleaned, repaired and painted. The pipes were then relaid to grade and fastened down with piles and cross timbers. A diver was also employed to examine Inlet Pipes Nos. 1 and 3, and all are now in good condition.

The steamer Milton D. Ward, which was for so long an eye-sore, and which interfered with the completion of the sewer outlet, has been removed by the city, under orders of the court, and the sewer completed.

The Hurlbut Memorial Library, Greenhouse and the improvements at end of canal, have been completed.

The library has been placed under the management of the Public Library Commission as a branch of the Detroit Public Library, and has already become a great convenience to the people living in that section of the city. It is open to the public from nine a. m. to nine p. m.

The lavatories have been completed, both on the grounds and in the Hurlbut Memorial Gate. A portion of the park, southwest of the engine house, has been regraded and sodded, adding materially to the appearance of the grounds.

A considerable amount of repairs was made to the dock, making it safe for the present, but in a few years it will require entire replanking.

Water Rates.

No change was made during the year in the rates for unmetered water. June 30, 1899, meter rates were adopted as follows: Monthly rate, first 10,000 gallons at five cents per thousand; all over 10,000 gallons, at one and three-fourths cents per thousand gallons; minimum rate, fifty cents per month. These rates are payable quarterly.

Economy of Waste.

HISTORICAL.

YEARS.	FAMILIES SUPPLIED.	WATER PUMPED.	
		TOTAL QUANTITY.	PER FAMILY.
1852	......	235,840,275	......
1853	4,283	303,531,743	70,868
1854	4,619	376,265,126	81,460
1855	5,282	542,807,364	102,765
1856	5,706	692,124,305	121,297
1857	6,189	697,190,523	112,650
1858	6,474	718,091,207	110,919
1859	6,794	782,112,587	115,118
1860	6,750	870,036,451	125,185
1861	7,128	895,129,423	125,579
1862	7,275	994,945,329	136,762
1863	7,699	1,035,798,043	134,534
1864	7,993	1,019,390,256	127.410
1865	8,351	1,040.514,887	125,675
1866	9,089	1,196,317,922	131,622
1867	10,242	1,425,535,230	139,186
1868	11,544	1,666,545,125	144,364
1869	12,774	1,946,810,325	152,400
1870	13,722	1,866,060,068	136,000
1871	14,896	2,300,150,605	154,414
1872	16,035	2,782,292,578	173,513
1873	17,019	3,198,393,948	187,930
1874	18,853	3,289,872,635	174,511
1875	19,606	4,207,454,260	214,600
1876	20,102	4,065,134,470	200,225
1877	20,345	4,213,239,790	207,090
1878	20,603	4,345,743,330	210,927
1879	21,341	5,129,599,110	240,348
1880	22,465	5,552,965,310	247.183
1881	23,749	6,543,127,968	279,722
1882	25,442	6,284,000,742	243,062
1883	27,415	7.379,327,788	269,170
1884	29,424	8,510,614,140	289,260
1885	30,533	9,970,829,580	326,886
1886	31,946	10,576,571,254	331,070
1887	34,486	13,168,859,808	381,860
1888	36,863	14,380,166,670	390,098
1889	39,158	12,875,334,453	328,880
1890	41,467	12,120,944,532	292,300
1891	43,933	12,057,261,236	274,470
1892	46,400	12,276,612,482	264,582
1893	49,817	13,877,977,208	278,579
1894	49,912	13,649,779,605	273,476
1895	51,426	14,698,451,954	285,818
1896	53,941	13,254,369,371	245,719
1897	54,945	12,928,821,326	235,305
1898	56,341	14,278,682,058	253,433
1899	58,931	16,348,062,701	277,410

The increase in consumption was largely due to the flushing of the system which has been carried on during the year, and to the unusually severe weather during the spring. The average daily pumpage in February was 55,564,681 gallons. The highest daily average was on February 13, when the pumpage was 80,602,380 gallons.

COMPARATIVE STATEMENT.

	1887.	1888.	1896.	1897.	1898.	1899.
Daily average consumption in gallons	36,079,068	39,397,716	36,318,340	35,421,430	39,092,252	44,789,218
Daily average consumption per capita	195	204	130	124½	135	147
Total annual consumption	13,168,859,808	14,388,166,670	13,254,369,371	12,928,821,326	14,278,682,058	16,348,062,701
Total consumption through meters	65,182,000	91,750,000	2,263,418,500	2,427,447,000	2,807,839,400	3,480,162,236
Revenue from unmetered water	$316,316.30	$335,140.10	$321,742.23	$256,164.17	$236,743.13	$257,411.97
Revenue from metered water	$6,518.20	$9,175.00	$84,405.59	$79,833.11	$57,253.06	$72,123.35
Per 1,000 gallons metered water	.10	.10	.037+	.033	.02	.02
Per 1,000 gallons unmetered water	.024	.023	.029+	.024+	.022	.02
Number of families supplied	34,486	36,863	53,941	54,945	56,341	58,931
Number of service connections	32,938	36,609	50,599	52,219	53,720	55,340
Miles of pipe	322	325	518	526	553	560
Number of meters	About 40	48	4,584	5,392	5,470	5,555
*Estimated population	184,829	194,996	279,107	284,319	291,181	303,800

* Population estimated by multiplying families in city by 5.14.

Pipeage System.

You are respectfully referred to the report of the Superintendent of Construction for a detailed report of the work done in this department during the year.

The total mileage of the distributing system January 1, 1900, was 560 miles and 1,957 feet, of which seven miles and 1,878 feet were laid during the year. Five miles and 1,298 feet were laid in the city, 3,465 feet were laid in the Village of Highland Park, 6,448 feet in the Village of Grosse Pointe and 534 feet in Hamtramck, making a total laid outside the city of 2 miles and 580 feet, the entire cost of which was paid by said villages; 852 feet of pipe were replaced by pipe of larger size.

All of which is respectfully submitted.

MARSHALL H. GODFREY,
General Manager.

REPORT OF THE CIVIL ENGINEER.

Detroit, January 31, 1900.

To the Honorable Board of Water Commissioners of the City of Detroit:

Gentlemen—In compliance with the regulations, the following annual report of the work performed by the Engineering Department for the year of 1899 is herewith respectfully submitted:

Distribution System.

Plate No. 1 is a self-explanatory map of the distribution system. The proposed high service district, in which the pressure is at present too low for the best domestic, manufacturing and fire service, is shown in red.

The necessary construction to remedy this defect has already been commenced, in accordance with the recommendations printed in last year's Annual. The undue strain on our old low pressure engines in attempting to supply the high territory indicated, was forcibly emphasized in September, when the main shaft of No. 1 Engine, fourteen inches in diameter, broke square off in the main journal. Fortunately, this accident occurred after the period of maximum summer consumption, instead of before.

The general flushing of the distribution system this year was much more thorough than that of a year ago. At that time there were only 19 large blow-off connections, and the flushing was confined principally to the large pipes.

During the past year, however, 18 additional connections were made to the sewers, in such a way that practically every block of pipe in the city can be flushed, except dead ends, which have to be cared for independently, as heretofore.

Gates were opened or closed in such a way as to force the water through each section of pipe flushed at a velocity of from 5 to 12 feet per second, depending on the size of pipe and its location. The large mains were found in better condition than when flushed one year ago, but the small lines of 4- and 6-inch pipe, many of which had never been flushed since laying, were found in a very foul condition. This was especially true of the central and northern residence districts on both sides of Woodward avenue. The work began on November 27, 1899, and was completed January 29, 1900.

During the month of November we used 86,000,000 gallons of water, and removed from the pipes on the east side of Woodward avenue 967 cubic yards of solid material. In January we used 56,000,000 gallons of water, and removed 583 cubic yards of material from the pipes west of Woodward avenue. The work was well done, and our pipe lines have never been as free from deposits of sediment as they are at the present time. For details of the cost of this work see report of Superintendent of Construction.

No cases of deterioration of our cast iron mains due to electrolysis have been found during the year, either in the pipes themselves or in the lead joints. However, the wrought iron pipes of the Detroit City Gas Co. have been very seriously damaged in many places, and in the investigations which they have conducted, our mains have repeatedly been found quite heavily charged, showing that all the conditions for electrolytic action are present and sure to cause trouble in time unless corrected. In the fall of 1896, the electrical conditions of our system were investigated and

local remedies applied. However, as local conditions have evidently changed considerably since that time, a second and thorough examination is advisable. Competent electrical engineers should be employed for this purpose.

Pressures.

A table showing the average water pressure at various points throughout the city, for each year from 1894 to 1899 inclusive, has been compiled from our records and is given below. The pressure at each point was observed and recorded once an hour, both night and day, making a total of 8,760 readings per year. The pressure here given is in each case a true average of all readings taken. The gauges used were tested two or three times each year and the proper corrections applied in each case. In designing house plumbing and for power purposes, it is necessary to know the extreme variations in pressure that are likely to occur, rather than the mean result. The highest and lowest pressure recorded at each location during the year of 1899 is therefore given. In selecting these extremes, abnormal results due to accidents or blow-offs have been rejected. The loss of pressure due to friction in the distribution system is also given for each year.

The last two columns show the increase in frictional loss for 1899 over 1898, in pounds and in percentages. The largest actual increase is about 2¼ pounds, which occurs in the southwestern district, near Twentieth street.

The most rapid rate of increase in friction is from 50 to 75 per cent, in the eastern portion of the city nearest the pumping station, and is for the most part to be found in the 42-inch distributing mains. With the exception of Engine No. 21, the rate of increase in friction in the northern portion of the city is about the same as in the central and southwestern portions, and ranges from 15 per cent to 36 per cent. By raising the average pressure at the pumping station about one pound, the pressures in the northern portion of the city have been maintained very nearly as high as during 1898. Experiments made in June show that the increasing friction in the northern portion of the city is due to an actual increase in consumption in that district, and that no farther relief can be obtained by closing or throttling additional gates.

LOCATION OF GAUGES.	Elevation gauges. City datum 0=480.30 sea level.	Elev. lbs. above surface pump wells 92.00, at which Eng. gauges are set.	Average Pressure, in Pounds.								Average Daily Gallons Pumped. / Frictional Loss, in Pounds.						Increase of friction during last year.	
											37,396,656	40,269,731	36,215,123	35,421,428	39,092,252	44,789,213		
			1894.	1895.	1896.	1897.	1898.	1899.	HIGH 1899.	LOW 1899.	1894.	1895.	1896.	1897.	1898.	1899.	lbs.	%
Pumping Station Gauges..	92.00	....	49.43	50.28	46.75	46.99	48.11	49.17	60.	40.	....	....	....	....	....	....	....	...
Eng. 7, Concord, n. of Jefferson....................	125.023	14.29	30.55	29.25	27.85	30.32	31.23	32.67	39.	25.	4.59	6.74	4.51	2.38	2.59	3.81	1.22	47
T. 6, Elmwood and Fort....	124.495	14.07	22.66	26.23	27.24	29.83	30.59	29.38	35.	20.	12.70	9.98	5.44	3.09	3.45	5.72	2.27	67
Eng. 2, Hastings, bet. Larned and Congress........	120.981	12.55	29.31	30.15	30.44	30.51	30.89	30.67	36.	20.	7.57	7.58	3.76	3.93	4.67	5.95	1.28	27
Water Office, Randolph and Jefferson................	125.176	14.36	26.79	25.72	26.45	27.40	27.56	27.64	32.	20.	8.28	10.28	5.94	5.23	6.19	7.17	0.98	16
T. 1, Wayne and Larned...	116.738	10.71	34.71	30.55	31.80	32.43	33.00	31.30	35.	26.	4.01	9.02	4.24	3.85	5.40	7.16	1.76	33
Eng. 3, Griswold and Clifford..	123.059	13.44	29.55	28.89	29.08	29.36	29.33	29.06	34.	24.	6.44	7.95	4.23	4.19	5.34	6.67	1.33	25
Eng. 8, Sixth and Baker....	121.072	12.58	26.49	25.56	26.39	28.84	29.82	29.10	36.	19.	9.76	12.14	7.78	5.57	5.71	7.49	1.78	31
Eng. 4, 18th, bet. Lafayette and Howard..............	116.179	10.46	29.80	29.68	30.59	28.94	28.75	27.59	33.	18.	9.17	10.14	5.70	7.62	8.90	11.12	2.22	25
T. 4, 20th near Rose........	124.825	14.21	27.87	27.60	26.82	25.77	25.29	24.05	30.	15.	7.35	8.47	5.72	7.01	8.61	10.91	2.30	27
Eng. 10, 16th and Bagg.....	125.282	14.41	24.94	26.62	27.37	26.68	26.43	25.15	30.	15.	10.08	9.25	4.77	5.90	7.27	9.61	2.34	32
Eng. 15, Hubbard, near Fort	114.977	9.95	29.59	30.03	29.58	28.52	27.90	27.42	33.	16.	9.89	10.30	7.22	8.52	10.26	11.80	1.54	15
Eng. 14, Scotten, near Michigan.....................	121.369	12 71	26.04	24.98	25.77	26.82	28.05	27.75	33.	18.	10.68	11.53	8.27	7.46	7.35	8.71	1.36	18
Eng. 22, Michigan, near Welch....................	119.444	11.88	....	....	28.19	28.05	27.72	26.80	33.	17.	....	....	6.68	7.06	8.51	10.49	1.98	23
Eng. 18, Mt. Elliott, near Sylvester................	146.270	23.49	22.40	21.44	20.38	22.06	23.42	23.72	31.	14.	3.54	5.35	2.88	1.44	1.20	1.96	0.76	63
Eng. 11, Grandy and Gratiot	143.211	22.17	21.15	18.41	17.79	20.87	22.54	21.71	28.	16.	6.11	9 70	6.79	3.95	3.40	5.29	1.89	56
Eng. 6, Russell and High..	144.845	22.88	19.20	18.25	18.98	19.56	19.50	19.11	25.	14.	7.35	9.25	4.67	4.55	5.73	7.18	1.45	25
Yard, Erskine and Riopelle	150.635	25.38	....	....	16.40	16.77	....	17.16	25.	11.	....	....	4.97	4.84	....	6.63	....	...
T. 5, Russell and Erskine...	147.742	24.13	17.19	16.40	16.84	17.36	18.22	18.02	23.	12.	8.11	9.75	5.78	5.50	5.78	7.02	1.24	21
Eng. 5, Alexandrine, nr. 2d.	146.693	23.68	20.33	17.20	16.34	17.92	18.52	18.67	24.	12.	5.42	9.40	6.73	5.39	5.91	6.82	0.91	15
Eng. 20, Baldwin and Gratiot	145.368	23.10	....	....	21.77	22.25	22.27	23.59	32.	15.	.....	....	1.88	1.64	1.42	2.48	1.06	75
Eng. 13, Russell and Ferry..	157.304	28.27	12.80	12.51	12.72	15.50	16.35	16.11	22.	10.	8.36	9.50	5.76	3.32	3.49	4.79	1.30	36
Eng. 17, Cass and Amsterdam.....................	152.825	26 33	17.02	17.04	15.88	16.44	16.99	16.92	23.	11.	6.08	6.89	4.54	4.22	4.79	5.92	1.13	24
Eng. 21, Lincoln, nr. Piquette	154.880	27.22	....	....	14.52	15.36	16.21	18.35	29.	12.	....	....	5.01	4.41	4.68	3.60	—1.08	...
Eng. 12, Gr. River and 16th	141.546	21.45	18.35	16.86	17.38	17.89	17.26	16.45	22.	8.	9.63	11.97	7.92	7.65	9.40	11.27	1.87	20

Consumption.

The daily consumption of water, mean temperature and rainfall is shown on Plate No. 2. The cold weather in February was unusually severe, and caused the largest consumption of water in the history of the Works. For five days the average temperature was 5 degrees below zero and the maximum range from 9 degrees above to 13 degrees below. During this period of five days, including a Sunday, the average daily consumption was 77,611,513 U. S. gallons. The maximum hourly rate occurred from 9 to 10 a. m. February 13, when the pumps registered 3,658,392 gallons, or at the rate of nearly 88,000,000 gallons per day of 24 hours.

All four engines were in service for two days, leaving no reserve for use in case of accident.

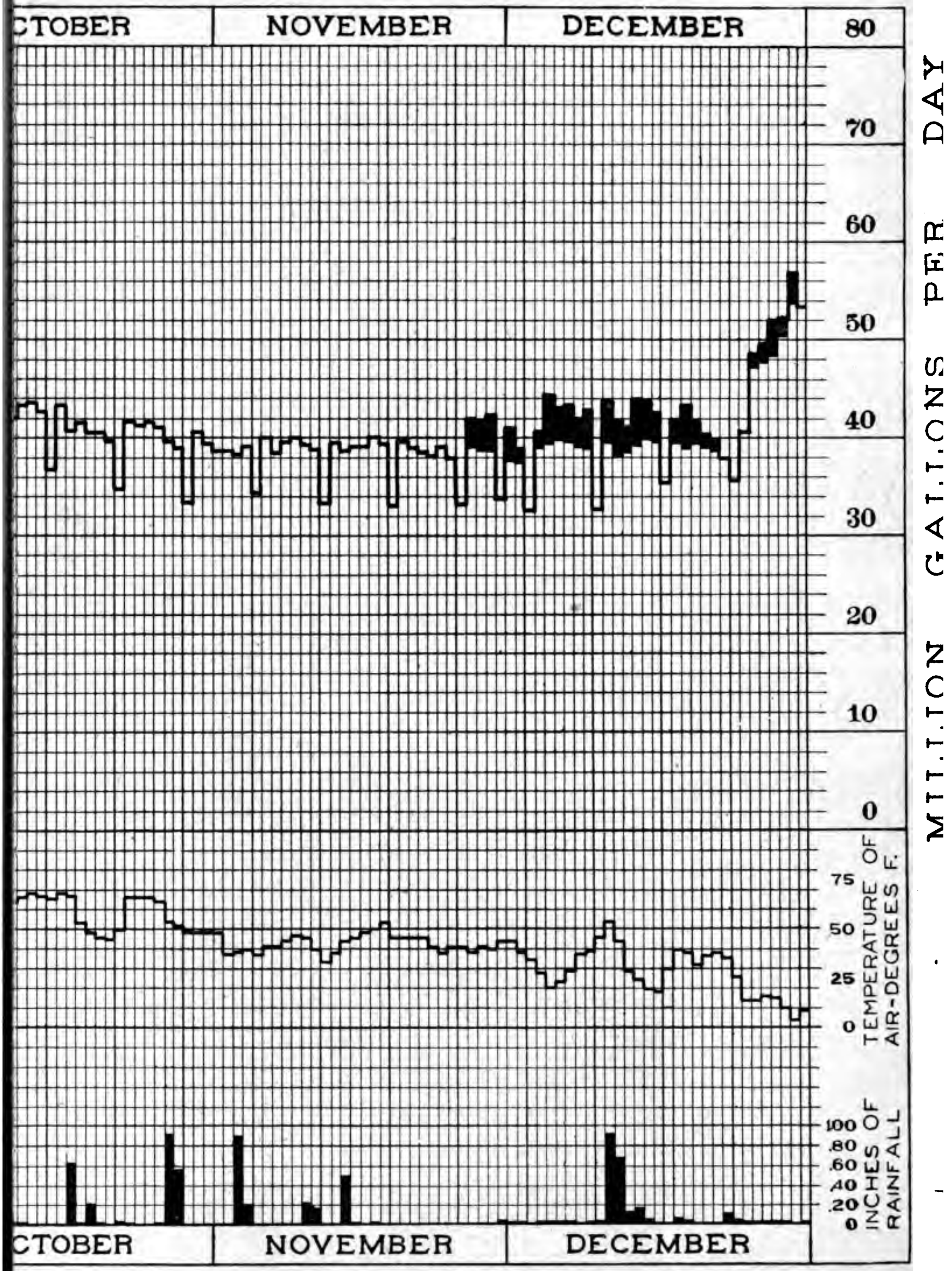
The average number of gallons pumped daily for the year is 44,789,213, and the number of persons actually supplied, estimated from the June census for the city, and from the number of taps for Delray and Highland Park, is 306,055, which gives a daily consumption of 146.3 gallons per person. No correction is made for water used for flushing purposes.

Excluding Delray and Highland Park, the increased use of water inside the city limits, metered and unmetered, is as follows:

Total water metered in 1899	3,425,487,986 gals.
" " " " 1898	2,792,842,400 "
Increased use of metered water	22.6 per cent.
Total water unmetered in 1899	12,867,900,465 gals.
" " " " 1898	11,470,788,658 "
Increased use of unmetered water	12.2 per cent.

As the capacity of the meters inside the city limits is practically the same for both years (see Report Superintendent of Meters), the above table shows conclusively that the cause of our rapidly increasing consumption, whatever it may

99.



CTOBER
NOVEMBER
DECEMBER
80
70
60
50
40
30
20
10
0
MILLION GALLONS PER DAY
75
50
25
0
TEMPERATURE OF AIR-DEGREES F.
100
.80
.60
.40
.20
0
INCHES OF RAINFALL
CTOBER
NOVEMBER
DECEMBER

be, affects both metered and unmetered consumption alike; in fact, the metered consumption has increased much more rapidly than the unmetered.

The use of water beyond the city limits has become considerable. The average daily for the year is as follows:

Metered	268,559
Estimated unmetered (227 connections)	190,680
Total	459,239 gals. per day.

The maximum hourly rate of consumption is about double the mean daily rate. It can therefore be safely said that the consumption outside the city limits has never exceeded the rate of 1,000,000 gallons per day of 24 hours. This is a comparatively small quantity, but in view of the rapidly increasing city consumption and the near approach to the limit of our pumping capacity, no considerable extensions beyond the limits should be made at the present time.

Inspection.

The new Detroit Water Works gate, designed by this department, and built under rigid inspection, has been subjected to severe tests, both in the shop and field, and has proved in every way satisfactory. It is strong, well made, and all parts, even the solid wedge discs, are absolutely interchangeable. The wedges are water tight and do not require hand scraping. We now have on hand patterns for 4, 6, 8, 10 and 12-inch sizes. All pipe and specials purchased during the year have been carefully inspected by this department. Also one 5-foot double-faced sluice gate.

Late in the fall John S. Quinn & Co. contracted to take up, paint, lower and relay 18 lengths of intake pipe No. 2 near the shore end for $5,300.00. This pipe was found in very bad condition; in one place there was an opening of four feet. It was found necessary to take up only 17 lengths of pipe. The last joint at the shore end was made with a sleeve six feet long. This work was carefully inspected, both during progress and after completion, and was done in a perfectly satisfactory and workmanlike manner, the net cost being $5,005.56.

The work of inspecting the condition of all three intake pipes and making such minor repairs as were required was left uncompleted by contractor and diver Duff Fecteau, on account of the lateness of the season, but will be completed in the spring. One bad break, probably caused by a dredge dipper, was repaired, a number of leaking joints repacked, and every other slat removed from the strainer box of Intake No. 2. The estimated cost of this work was $1,500.00, and the cost to date has been $972.00.

Drafting Room.

The regular force in the drafting room has remained unchanged. Although there has been no large construction, the routine work of the office has been fully as heavy as ever before. In addition to keeping all atlases, maps and inspectors' plats posted to date, 498 drawings were made or corrected, and 5,139 blue prints were taken. Of this number, 1,105 prints were retained in the office for reference or filed in the vault to guard against loss by fire, and 4,034 were furnished for construction and other purposes. We have the most complete set of drawings in the city of the underground systems of Detroit, and there is considerable demand for them from gas, telephone and other companies who do more or less work in the streets and alleys. During the year we have received $238.63 for blue prints sold.

Few connections to water pipes are now made without someone, usually the plumber, obtaining from this office the location of the main in the street. This enables him to make an estimate of the cost of the work and avoid unnecessary trenches, saves pavements, lessens obstructions to traffic, and hence danger, and saves cost. There are now few places in the city that the pipe is not fairly well located.

All of which is very respectfully submitted.

C. W. HUBBELL,
Civil Engineer.

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

Detroit, January 10, 1900.

To the Board of Water Commissioners:

Gentlemen—In compliance with the rules and regulations of your honorable body, I herewith report the work done in the Meter, Inspection and Service Cocks Department during the year 1899.

NUMBER OF METERS PLACED DURING THE YEAR, AND TOTAL NUMBER IN SERVICE JANUARY 1, 1900.

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
In service Jan. 1, 1899.........	3,121	1,044	776	214	188	78	43	6	5,470
Placed during the year 1899...	76	27	82	26	18	8	3	4	244
	3,197	1,071	858	240	206	86	46	10	5,714
Removed during the year 1899	75	34	29	5	11	4	1	......	159
Total number in service Jan. 1, 1900....................	3,122	1,037	829	235	195	82	45	10	5,555

IN SERVICE JANUARY, 1, 1900.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson......................	3,076	1,016	747	222	163	66	30	10	5,330
Crown..........................	28	13	40	10	9	7	4	......	111
Hersey	1	4	32	2	11	2	8	......	60
Worthington..................	8	4	10	......	11	7	1	......	41
Union Rotary................	8	......	......	1	1	......	1	......	11
Buffalo.........................	1	......	......	......	......	......	......	......	1
Venturi.........................	......	......	......	......	......	......	1	......	1
Aggregate..............	3,122	1,037	829	235	195	82	45	10	5,555

Indicators attached to hydraulic elevators..................................... 30

METERS IN STOCK.

KIND.	SIZES.					
	¾ in.	1 in.	1½ in.	2 in.	3 in.	Total
Thomson	6	22	10	1	2	41
Crown	......	1	1	2	2	6
Hersey	......	8	......	1	......	9
Aggregate	6	31	11	4	4	56

Valuation of meters in stock January 1, 1900	$1,163 00
Valuation of material on hand January 1, 1900	491 81
Valuation of tools, etc., January 1, 1900	438 37
Valuation of horse, wagons, etc., January 1, 1900	274 50
Valuation of furniture, fixtures, etc., January 1, 1900	105 00
Total valuation of stock on hand January 1, 1900	$2,472 68

Valuation of meters in service January 1, 1900		$102,804 27
Deduct 5 per cent for depreciation in value	5,140 20	
Deduct for meters sold	38 40	5,178 60
		$97,625 67
Add amount expended during the year for meters placed		2,579 07
Total valuation of meters in service January 1, 1900		$100,204 74

SUMMARY OF TOTAL AMOUNT EXPENDED IN THE METER DEPARTMENT FOR THE YEARS 1889 TO 1899, INCLUSIVE.

	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	TOTAL
Meters.................. ..	$11,175 00	$18,700 00	$6,501 55	$12,371 82	$6,987 43	$8,824 08	$9,235 11	$10,435 76	$7,955 97	$1,790 75	$2,265 70	$96,248 17
Supt. and labor	1,734 10	8,510 57	4,841 49	8,269 17	8,980 48	6,672 20	6,647 89	6,340 08	6,078 78	4,531 11	4,223 54	66,829 41
Material, tools, etc........	637 26	2,982 14	872 99	2,132 93	1,650 33	1,833 01	1,384 85	1,085 15	927 90	568 99	375 32	14,400 87
Freight, hauling, etc......	98 05	408 97	197 11	244 08	165 12	201 18	71 40	91 11	67 90	13 16	6 85	1,564 93
Horses, wagon, etc........	....	....	....	547 24	184 50	383 07	248 60	238 51	330 80	187 50	244 25	2,364 47
Aggregate.............	$13,644 41	$30,601 68	$12,413 14	$23,565 24	$17,967 86	$17,913 54	$17,587 85	$18,140 61	$15,361 35	$7,091 51	$7,115 66	$181,402 85

The work in the Meter Department during the past year has been conducted along the same lines as the preceding year. We have placed 244 meters, and removed 159, making a net increase of 85. The total number now in service is 5,555, from which should be deducted 1,113, that being the number transferred to the assessment roll, and from which no meter rates are received, thus leaving 4,442 meters in actual service.

The greater portion of the meters still remain on the premises of those who were transferred to the assessment roll. Where we have occasion to use a ⅝-inch meter, we remove it from one of the before-mentioned premises.

There seems to be no question but what the meter has a restraining influence over the waste of water, especially so where the consumer pays by meter rates. For instance, taking 35 residences that are metered and which pay by assessment, we find their consumption for the past year was 6,762,750 gallons, a daily per capita consumption of 106 gallons, while these same places when paying by meter rates consumed 2,907,700 gallons in the same length of time, being a daily per capita consumption of 45 gallons. Again, taking 20 residences in another part of the city, all metered, ten of which pay by assessment, the other ten paying by meter, and we find the daily per capita consumption for the year to be 84 gallons and 39 gallons respectively. Notwithstanding the meter's restraining influence, the consumption of those who paid by assessment was over double of those paying by meter rates. There is no doubt that were the meters removed from those who pay by assessment, their consumption would increase very materially, as we have found some individual cases where their consumption has been over 200 gallons per capita daily. The foregoing premises are supplied with modern water fixtures, hose, etc., and on such premises the meter proves that from 40 to 60 gallons per capita daily is all that is legitimately required. The average family on metered service, not having more than one hydrant each, seems to use about 20 gallons per capita daily, and yet there are some that use 120 gallons, the greater portion of which must necessarily go to waste, the expense of which is borne by the owner instead of the Water Department. On unmetered connections, however, which are in a large majority, the Water Department bears the expense of all waste.

The record for high consumption on a metered service was broken during the past year by two families with two sinks and two closets, having a daily per capita consumption of 694 gallons, being another instance where the owner suffered by having the premises metered.

Every time the meters are read brings to light more or less leaks, and many of them are of large proportions, and which would seldom be discovered were it not for the meter. During the last reading we discovered one where the consumption had increased gradually from 450,000 gallons per month until it reached 2,325,000 gallons per month, when the owner thought it time to remedy the defective plumbing. The leak was found in a cast iron service pipe under concrete floor in basement, the water finding its way to the sewer without coming to the surface.

The per capita consumption throughout the city for the past year was 147 gallons, being an increase of 23 gallons over 1897 and 14 gallons over 1898. Since 1888 the consumption has shown a per capita decrease each year (with the exception of 1895) until 1898. Whether the fact that we stopped metering domestic consumers to a large extent, had anything to do with the increased consumption, I am not prepared to say, but the two years that we placed the most meters shows the greatest decrease, as during the years 1896 and 1897 there were placed 1,618 meters, and the reduction was 15 gallons per capita, while in the years 1898 and 1899 we placed 162 meters and transferred about 1,100 from the meter to the assessment roll, and the increased per capita has been 23 gallons.

Previous to last year we had deducted ten per cent each year for depreciation in the value of meters in service. At that time we reduced it to five per cent, and now by examining meters that have been in service ten years we find them to all appearances as good as ever. We have two 6-inch meters that have registered 348,222,000 and 282,613,500 gallons respectively during that time, and with the exception of a portion of the gear in one of them being replaced, there has been no expense attached to their care, and they are still in excellent condition and will undoubtedly give good service for ten years more without any material expense for repairs. The smaller meters show the same relative results, which proves that we were justified in reducing the percentage for depreciation.

Inspection.

There has been no change in the Inspection Department during the past year so far as the duties of the Inspectors are concerned. As the city increases in size their duties increase accordingly. And it has been necessary at times to give them some assistance, especially during the time in which the assessments are being made. Some of them have had no time to devote to the inspection of leaks, while others have been able to inspect their wards fairly well, but on the whole we are falling off in that important work, something I think it will be wise to remedy eventually by making an addition to the present force.

The following will show a portion of the work done by the Inspectors during the past year, viz:

New connections examined	1,695
Extensions examined	782
Buildings inspected	3 235
Fixtures inspected	6,303
Let on new connections	1,090
Let on vacancy and non-payment	2,524
Building tax notices	1,521
Delinquents notified	70,571

Shut off for non-payment	743
Shut off for vacancy	2,081
Inquiries for collectors	13,577
Meters read	21,626
Meter bills delivered	18,288
Leaks reported	1,363
Total	145,399

Service Cocks.

Sixteen hundred and thirty nine (1,639) service connections were made during the past year; 1,129 were ⅝-inch, 453 1-inch, 24 2-inch, 6 3-inch, 17 4-inch and 10 6-inch. Twelve (12) ⅝-inch and 7 1-inch were discontinued, making the total number of service connections in the city on the first day of January, 1900, 55,340.

Of the 10 6-inch connections, 2 were for fire protection, 7 for hydraulic elevators and 1 for commercial purposes. Of the 17 4-inch connections, 9 were for fire, and 1 for hydraulic elevator. One 3-inch was also put in for fire protection. The balance of the large connections were for commercial purposes, many of them being reduced in size after entering premises, and all that are in use have meters attached.

Thirteen (13) 2-inch connections were made at Belle Isle Park, for the Board of Park and Boulevard Commissioners, which are not included in the foregoing figures.

There were inserted for the Village of Highland Park 7 ⅝-inch and 3 1-inch connections, making the total number of connections in said village 58, consisting of 26 ⅝-inch, 31 1-inch and 1 3-inch.

The total quantity of water consumed in the village for the year was 16,071,000 gallons, as against 14,997,000 gallons for the previous year, their daily per capita consumption being about 147 gallons.

We also inserted in the Village of Delray 43 ⅝-inch and 3 1-inch connections previous to May 1st. Since that time they have done their own tapping. The total number of taps in the village is 448, consisting of 393 ⅝-inch, 46 1-inch, 2 2-inch, 2 3-inch, 1 4-inch and 4 6-inch. Of the 6-inch connections 1 is not in use and shut off, 2 are reduced to 4-inch inside of premises, leaving only 1 that can be used to its full capacity. The 4-inch connection is reduced to 2-inch, the 2 3-inch to 1½-inch and the 2 2-inch to 1-inch inside of the premises.

The total consumption in the village from April 1st (that being the date the plant was turned over to them) was 38,573,250 gallons for the nine months, which would indicate their consumption to be about 48,000,000 gallons per year.

Receipts for service cocks during the year	$4,689 25
Receipts for plumber licenses	618 50
Total receipts in Service Cocks Department	$5,307 75

TABLE showing the number of taps made, and different sizes, in each ward during the year 1899.

INSERTED.	WARDS.																	Total.
SIZES.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
⅝-inch	57	12	79	25	47	25	40	52	79	72	46	37	94	88	59	192	125	1,129
1-inch	95	70	34	39	10	21	17	21	9	17	12	9	10	18	22	7	42	453
2-inch	5	4	...	2	1	...	5	1	1	...	4	...	...	...	1	...	...	24
3-inch	...	1	2	...	...	...	...	...	...	...	...	1	1	...	1	...	...	6
4-inch	3	2	...	...	...	2	3	1	1	2	...	...	1	..	2	...	...	17
6-inch	3	4	...	...	...	...	...	...	...	...	1	...	...	1	...	1	...	10
Aggregate	163	93	115	66	58	48	65	75	90	91	63	47	106	107	85	200	167	1,639
DISCONTINUED.																		
⅝-inch	4	...	1	...	...	1	1	2	1	...	...	...	...	...	...	...	2	12
1-inch	3	...	...	...	...	...	...	1	...	...	...	...	...	...	2	...	1	7
Aggregate	7	...	1	...	...	1	1	3	1	...	...	...	...	...	2	...	3	19

TABLE SHOWING THE NUMBER OF SERVICE CONNECTIONS IN USE JANUARY 1ST, 1900.

	No. in Use Jan. 1, 1899.	Added in 1899.	Discontinued in 1899.	Total in Use Jan. 1, 1900.
⅝-inch	39,321	1,129	12	40,438
1 "	13,834	453	7	14,280
2 "	273	24	....	297
3 "	162	6	....	168
4 "	112	17	....	129
6 "	17	10	....	27
10 "	1	....	....	1
	53,720	1,639	19	55,340

TABLE SHOWING CONNECTIONS IN DELRAY AND HIGHLAND PARK.

	Inserted in 1899.		Previous to 1899.						TOTAL
	⅝-in.	1-in.	⅝-in.	1-in.	2-in.	3-in.	4-in.	6-in.	
Delray	168	11	225	35	2	2	1	4	448
Highland Park	7	3	19	28	...	1	...	...	58
Aggregate	175	14	244	63	2	3	1	4	506

Attached to this report is a complete list of tools on hand, and an itemized account of material in stock in the meter and inspection departments on the 31st day of December, 1899.

All of which is respectfully submitted.

T. R. PUTNAM,
Supt. Meters and Inspection.

REPORT OF CHIEF ENGINEER AT PUMPING WORKS.

To the Board of Water Commissioners:

Detroit, January 1, 1900.

Gentlemen — I have the honor to submit the Engineer's report for the year 1899.

The following table shows the number of gallons of water pumped, and cost of fuel for the years named:

YEAR.	GALLONS OF WATER PUMPED.	COST OF FUEL CONSUMED.	AVERAGE DAILY DELIVERED.
1852	235,840,271	....	646,411
1853	303,531,743	$2,129 37	931,594
1854	376,265,126	2,271 34	1,030,866
1855	542,807,364	3,325 81	1,487,143
1856	692,124,305	4,017 44	1,896,231
1857	697,190,523	3,993 20	1,909,837
1858	718,091,207	3,655 20	1,967,373
1859	782,112,587	3,194 15	2,142,774
1860	870,036,451	4,196 21	2,383,580
1861	895,129,423	4,414 07	2,452,409
1862	994,945,329	3.150 95	2,725,878
1863	1,035,798,043	4,670 86	2,837,803
1864	1,018,390,256	7,647 62	2,839,078
1865	1,049,514,887	7,372 89	2,875,383
1866	1,196,317,922	9,349 16	3,277,583
1867	1,425,535,230	10,121 82	3,905,576
1868	1,666,545,125	11,379 23	4,507,248
1869	1,946,810,325	11,247 92	4,511,809
1870	1,866,060,068	12,713 78	5,112,493
1871	2,300,150,605	14,681 05	6,301,782
1872	2,782,292,578	17,736 86	7,601,892
1873	3,198,393,948	20,233 30	8,762,723
1874	3,289,872,635	20,431 71	9,013,350
1875	4,207,454,260	21,393 98	11,527,272
1876	4,065,134,470	19,832 89	11,107,499
1877	4,213,239,790	17,433 72	11,543,123
1878	4,345,743,330	10,943 82	11,906,146
1879	5,129,599,110	11,219 51	14,053,696
1880	5,552,965,310	12,276 60	15,172,036
1881	6,543,127,968	16,556 63	17,926,377
1882	6,284,000,742	13,156 16	17,261,440
1883	7,379,327,188	16,495 99	20,217,334
1884	8,510,614,140	19,877 07	23,253,044
1885	9,970,829,580	21,341 48	27,317,341
1886	10,576,571,254	20,387 24	28,976,907
1887	13,168,859,808	35,882 83	36,079,166
1888	14,380,166,670	39,568 66	39,397,716
1889	12,875,334,453	34,413 31	35,274,888
1890	12,120,944,532	31,852 40	33,209,067
1891	12,057,261,236	33,826 86	33,033,592
1892	12,476,612,482	31,034 40	34,182,499
1893	13,877,977,208	27,479 93	38,021,855
1894	13,649,779,605	29,283 47	37,396.656
1895	14,698,451,954	32,095 00	40,269,731
1896	13,254,369,371	31,186 17	36,215,123
1897	12,928,821,326	17,355 58	35,421,428
1898	14,278,682,058	17,880 19	39,092,252
1899	16,348,062,701	19,011 67	44,789,212

The following tables show in detail the work done by each engine each month of the year:

ENGINE No. 1.

MONTHS.	Time run.		Revolutions.	Gallons Water.
	H.	M.		
January	728	5	429,372	521,888,106
February	397	10	245,863	285,508,230
March	63	55	36,755	28,889,430
April	....	....	....	....
May	....	....	....	....
June	127	20	69,705	54,786,130
July	309	25	178,835	191,576,400
August	386	10	240,194	305,449,350
September	11	35	6,465	5,081,490
October	91	20	47,775	38,252,190
November	510	35	287,680	355,689,660
December	665	....	379,770	430,378,560
Total	3,290	35	1,922,414	2,217,501,546

ENGINE No. 2.

January	309	20	187,330	295,199,520
February	112	30	73,525	105,809,640
March	....	....	....	....
April	102	55	68,110	80,090,160
May	419	15	266,730	364,464,720
June	508	5	321,405	428,824,080
July	194	45	126,145	154,632,120
August	289	40	188,260	273,445,800
September	287	55	177,050	147,058,790
October	284	20	160,850	163,472,160
November	26	15	16,135	20,979,240
December	....	....	....	....
Total	2,535	....	1,585,540	2,038,976,230

ENGINE No. 3.

January	437	10	272,386	490,294,800
February	624	50	393,281	707,905,800
March	744	....	457,970	824,346,000
April	654	20	414,365	640,644,500
May	732	40	466,855	797,323,700
June	707	40	451,195	783,759,130
July	650	40	410,675	655,505,720
August	454	....	288,260	452,661,650
September	689	35	423,010	637,019,170
October	619	5	367,835	520,201,240
November	693	45	424,020	762,970,200
December	737	10	456,500	819,458,420
Total	7,744	55	4,826,352	8,092,090,330

ENGINE No. 4.

January	45	30	37,830	29,696,550
February	630	55	581,640	456,587,400
March	741	15	654,290	513,617,650
April	659	5	622,082	488,334,370
May	176	55	169,130	132,767,050
June	178	40	171,730	134,808,050
July	588	5	588,835	462,235,475
August	735	....	761,615	597,867,775
September	701	50	697,575	547,596,375
October	744	....	687,540	539,718,900
November	26	40	24,880	19.530,800
December	106	....	104,200	81,734,200
Total	5,333	55	5,101,347	4,004,494,595

TOTAL EXPENSE FOR PUMPING WATER.

Fuel, coal consumed	$19,011 67
Salaries, engineers, et al	20,178 81
Repairs, boilers and machinery	2,126 61
Supplies, oil and waste	588 35
" soap, polish, etc.	88 35
" valves, gaskets, etc	254 83
" electric light	61 25
" farrier	4 00
" stationery	8 00
" ice	22 83
Horse expense	67 65
Boiler inspection	36 00
Total	$42,448 35

The cost of fuel per million gallons pumped is $1.16, and per million gallons pumped 100 feet high is $1.03.

The table shows that the amount of water pumped during the year was 16,348,062,701 gallons, which is an increase of 14½ per cent compared with that of 1898.

The total expense for pumping water, including heating, lighting and a new shaft for Engine No. 1, was $42,448.25, thus making the cost per million gallons pumped $2.60, a decrease of 4 per cent from that of 1898.

The engines are all in fair condition. The station duty of coal consumed for all purposes for 1899 was 94,427,762 pounds.

No. 1 engine, which has been so reliable for the past 23 years, was disabled September 1st, the main shaft breaking in the main journal. It was very fortunate that no further damage ensued and that it occurred prior to the time for our maximum pumping. My opinion as to the cause of the break was that the shaft was one inch smaller in the main journal than the shaft proper, and that the distance from the center of crank pin to the center of main journal is four feet, thus leaving a long overhang, a great detriment to the shaft, owing to the constant spring in the working of the shaft, which causes it in time to crystallize and consequently give out. We are also working the engine 20 per cent above former years. The old shaft was replaced by a new one, which is 14 per cent stronger.

Our intentions were to change the H. P. cylinder and valve gear of No. 1 engine, but we were not able to do so on account of the boilers not being in place as soon as was expected. The change would increase its efficiency about 15 per cent.

No. 2 engine, of which the foundation and main pillow block have been working loose for a number of years, received a good overhauling by strapping the pillow blocks, drilling holes in foundation and forcing cement underneath. I can now state that it is as solid as ever.

No. 3 engine, which was altered last year, has been running the greater part of the time, and has proved very satisfactory, and is still in good condition.

No. 4 engine was running the greater part of the year, and is in good condition.

The four horizontal tubular boilers in the west room and the four horizontal water tube boilers in the middle room are in good condition.

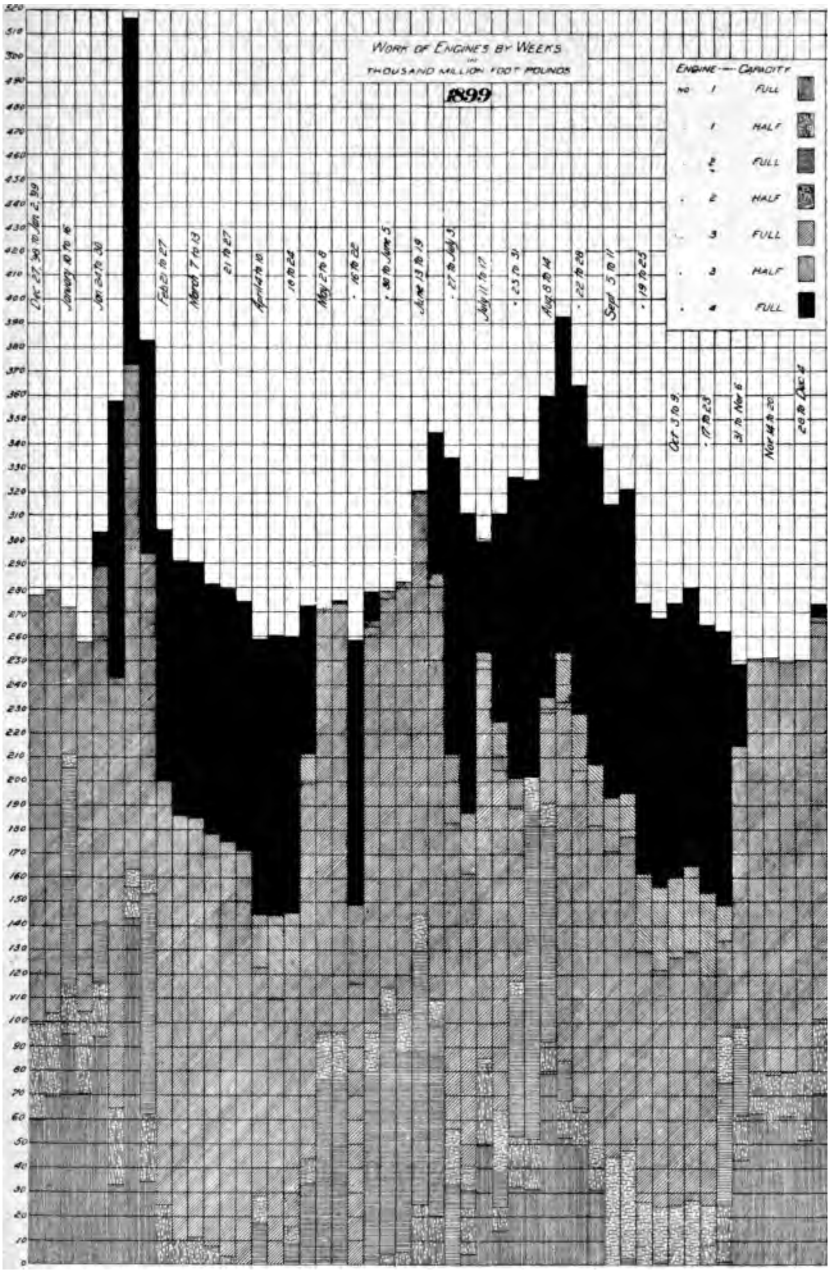
The four vertical water tube boilers, which are now in place and are being fitted up at this writing, I expect will prove satisfactory.

In building the 120 feet addition to the east end of the pumping station, I think it is a good plan to build a basement under the entire addition. It would be very convenient in removing any part of the machinery when required, and also for stopping any leaks that may occur on the inside of addition.

With the aid of the new pumps and a 20-ton crane to travel the entire length of the building, I would consider everything to be in good condition. The engine house and coal sheds are in a fair condition, and as we now have most of the boilers equipped with mechanical stokers we expect to abate the smoke nuisance to a certain extent, so that whenever these buildings are again painted they will keep their fresh color much longer.

All of which is respectfully submitted.

URIAH GOULD,
Chief Engineer at Pumping Works.


WORK OF ENGINES BY WEEKS
IN
THOUSAND MILLION FOOT POUNDS
1899
ENGINE — CAPACITY
NO. 1 FULL
" 1 HALF
" 2 FULL
" 2 HALF
" 3 FULL
" 3 HALF
" 4 FULL
Dec 27, '98 to Jan 2, '99
January 10 to 16
Jan 24 to 30
Feb 21 to 27
March 7 to 13
" 21 to 27
April 4 to 10
" 18 to 24
May 2 to 8
" 16 to 22
" 30 to June 5
June 13 to 19
" 27 to July 3
July 11 to 17
" 25 to 31
Aug 8 to 14
" 22 to 28
Sept 5 to 11
" 19 to 25
Oct 3 to 9
" 17 to 23
31 to Nov 6
Nov 14 to 20
28 to Dec 4
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
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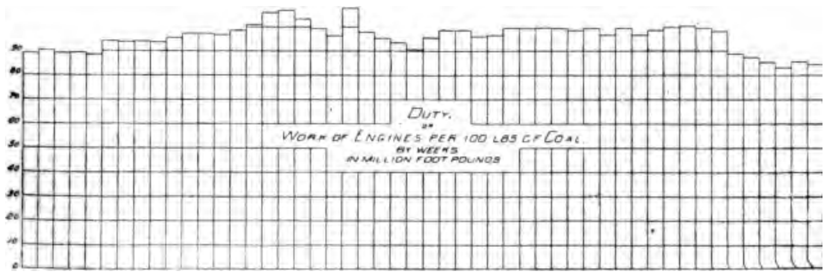
DUTY.
OR
WORK OF ENGINES PER 100 LBS OF COAL.
BY WEEKS
IN MILLION FOOT POUNDS
0
10
20
30
40
50
60
70
80
90

REPORT OF THE SUPERINTENDENT OF CONSTRUCTION.

Detroit, January, 1900.

To the Board of Water Commissioners:

Gentlemen—I herewith submit to your honorable body the annual report of the Construction Department.

The amount of distribution pipe ordered by the Board during the year aggregates $7\frac{1878}{5280}$ miles.

In the early spring the unfinished work of the Delray system was completed and the system turned over to the village April 1st.

Work at the Pumping Works and Grounds.

The uncompleted sewerage discharge into the river at the Pumping Works was completed immediately after the old steamboat M. D. Ward had been removed, and the sewerage in and about the Engineer's residence was entirely reconstructed with iron pipe.

Electric Plant.

The underground conduits and electric wiring was extended from the Engine House to the Hurlbut Gate, to the library, to the Engineer's house, to the new toilet pavilions at the west side and southern extremities of the grounds, and to post lamps at different points along the route, thus completely lighting the entire Pumping Works Park and the buildings therein.

Through the kindness of the Public Lighting Commissioners, the services of their electrician, Mr. Steel, were tendered, who planned and personally superintended the construction of the above work.

The construction of a five-foot conduit between Engines Nos. 2 and 3, commenced early in the winter, will not be completed much before February 1, owing to a long delay in getting from the manufacturers the large dividing gate to be placed therein.

Distribution System.

Pipe laid outside the city during the past year was as follows: In the Village of Delray, 693 feet; in the Village of Highland Park, 3,465 feet; in the Township of Grosse Pointe, $1\frac{168}{5280}$ miles; in the Township of Hamtramck, 534 feet; total outside the city limits, $2\frac{580}{5280}$ miles; and within the city, $5\frac{1298}{5280}$ miles. The Board now owns $33\frac{1560}{5280}$ miles outside the limits of the city; 852 feet of small pipe was discontinued, making a net increase to the system of $7\frac{1026}{5280}$ miles, and a grand total of $560\frac{2805}{5280}$ miles of the different sizes, as follows:

Size of Pipe in Inches.	Measured Length in Feet for 1898.	Added Length in Feet for 1899.	Discontinued Length in Feet for 1899.	Total Length in Feet for 1899.
45	103			103
42	59,491			59,491
36	715			715
30	54,494			54,494
24	84,587			84,587
20	393			393
18	87			87
16	53,805			53,805
12	37,227	335		37,562
10	159,063	520		159,583
8	311,920	2,936		314,856
6	1,303,706	30,955	80	1,334,581
4	789,170	2,573	367	791,376
3	64,038		405	63,633
2	2,820	1,519		4,339
Total,	2,921,619	38,838	852	2,959,605

At the close of this report will be found a descriptive list of the different lines of pipe laid, with locations, lengths, sizes and cost of construction in detail.

The rapid rise of the prices of all materials entering into the construction of the lines, together with some increase in the cost of labor, over the previous year, makes the cost considerably more than in former years. I also submit an inventory of the property, tools, materials, etc., on hand at the beginning of the present year.

There have been placed during the year 30 tees in the new lines for the use of the Fire Department.

Gates.

The total number of gates now in the distribution system amounts to 6,736 of the different makes and sizes, as follows:

GATES IN SYSTEM JANUARY 1ST, 1900.

	42-In.	36-In.	30-In.	24-In.	20-In.	18-In.	16-In.	12-In.	10-In.	8-In.	6-In.	4-In.	3-In.	Total.
Murdock	5	...	11	16	...	...	27	48	188	460	1,640	1,339	11	3,745
Flowers	20	...	9	18	...	...	...	...	39	52	240	431	20	829
Galvin	...	1	7	12	...	...	21	...	13	31	171	258	1	515
Michigan Brass and Iron Works	10	...	9	2	11	...	13	11	63	151	767	112	...	1,149
Pittsburg	...	...	...	15	...	2	1	1	10	11	30	123	...	193
Roe Stephens	...	...	...	...	...	...	...	6	....	4	43	....	...	53
Eddy	...	...	...	...	...	...	...	...	15	4	6	9	...	34
Scowden (Scott)	...	...	...	...	...	...	...	...	7	19	45	12	...	83
Ludlow	...	...	...	...	...	...	...	...	1	2	9	7	...	19
St. Louis	...	...	...	...	...	...	...	3	....	....	....	....	...	3
Detroit Water Works	...	...	...	...	...	...	...	...	...	8	56	....	...	64
Prong	...	...	...	...	..	...	...	...	....	....	1	....	...	1
Boston	...	...	...	...	...	...	...	...	....	1	1	....	...	2
Newport	...	...	...	...	...	...	...	...	....	....	....	1	...	1
No Name	...	..	...	...	...	...	...	...	....	3	9	32	1	45
Total	35	1	36	63	11	2	62	69	336	746	3,018	2,324	33	6,736

There were added to the distribution system during the year 1899, 98 gates, as shown by the following table:

GATES SET, 1899.

	3-in.	4-in.	6-in.	8-in.	10-in.	12-in.	16-in.	Total
Murdock	1	10	5	....	2	1	....	19
Scott	....	10	1	....	1	....	....	12
Michigan Brass & Iron Works	....	3	....	....	1	....	1	5
Flowers	....	1	....	....	....	....	....	1
Detroit Water Works	....	....	55	6	....	....	....	61
Total	1	24	61	6	4	1	1	98

There were taken out of the system 16 gates, as shown by the following table:

TABLE OF GATES TAKEN OUT OF SYSTEM.

No. of each kind.	KIND.	SIZE.	REMARKS.
1	Ludlow	6-in.	Shut-off System.
1	Murdock	6-in.	" "
3	Pittsburg	4-in.	" "
2	Ludlow	4-in.	" "
1	Ludlow	4-in.	Blow-off "
3	Murdock	4-in.	Shut-off "
1	Flowers	4-in.	" "
2	Michigan Brass and Iron Works	4-in.	" "
1	Murdock	4-in.	Blow-off "
1	Flowers	3-in.	Shut off "
16	Total.		

There have been set and re-set for blow-offs during the year 39 gates, as shown by the following table:

No. of each kind.	GATES SET AND RE-SET FOR BLOW-OFFS.	SIZE.	REMARKS.
1	Murdock	12-in.	Set New.
3	St. Louis	12-in.	" "
3	Murdock	10-in.	" "
1	Pittsburg	10-in.	" "
5	Michigan Brass and Iron Works	10-in.	" "
3	Scott	10-in.	" "
2	Detroit Water Works	8-in.	" "
1	" " "	6-in.	" "
2	Flowers	4-in.	" "
2	Scott	4-in.	" "
6	Murdock	4-in.	" "
1	Michigan Brass and Iron Works	4-in.	" "
6	Murdock	4-in.	Re-set.
1	Michigan Brass and Iron Works	4-in.	"
1	Ludlow	4-in.	"
1	Flowers	4-in.	"
39	Total.		

Of the 39 gates above referred to, 19 were set in pipes connected with the sewers of the city, and are used exclusively for flushing the mains. The following table will show their location, size, and cost of construction in detail:

BLOW-OFFS FOR FLUSHING PURPOSES.

Date.	LOCATION OF PIPE.	Feet.	Size.	DETAILED COST OF CONSTRUCTION.										
				Pipe.	Specials.	Lead.	Gates.		Sundries.	Gate-wells.	Hauling.	Re-paving	Labor.	Total Cost.
							Kind.	Cost.						
Oct. 18.	Bagg and Fourteenth	14	12 in.	$15 76	$27 47	$18 20	12 M	$65 00	$2 05	$34 83	$2 00	....	$107 18	$272 49
Nov. 15.	Beaubien and Brady	9 ft. 4 in.	8 in.	5 99	9 41	5 20	8 D W	13 75	57	26 65	2 00	....	35 88	99 45
Nov. 17.	Beaubien and Watson........	10 ft. 8 in.	10 in.	8 83	27 71	12 48	10 B G	20 00	1 81	33 22	2 00	....	51 96	158 01
Nov. 23.	Beaubien and Columbia	5 ft. 5 in.	10 in.	4 49	13 67	6 22	10 M A	20 00	1 06	60 63	2 00	....	40 12	148 19
Nov. 9.	Cass and Kirby...............	12 ft. 6 in.	10 in.	14 96	18 09	10 40	10 P	20 00	1 92	41 01	4 50	....	75 21	186 09
Nov. 16.	Chene and Cleveland.........	27	10 in.	29 92	26 57	8 64	10 B	20 00	2 79	35 12	4 50	$5 10	94 07	226 71
Nov. 21.	Collins and Farnsworth	31	10 in.	29 93	36 19	12 48	10 B	20 00	12 51	57 44	3 00	....	168 47	340 02
Oct. 30.	Eighteenth and N. Boulevard	13	10 in.	10 82	33 79	18 20	10 B	20 00	3 35	41 37	2 50	....	143 87	273 90
Oct. 31.	McDougall and N. Boulevard.	86	12 in.	94 26	21 29	11 76	....	....	2 34	....	3 50	....	134 44	267 59
Nov. 23.	Orleans and Gratiot..........	7 ft. 4 in.	10 in.	6 07	20 43	8 32	10 M	20 00	92	32 50	2 00	....	55 89	146 13
Dec. 1.	Russell and Farnsworth......	28	10 in.	23 04	23 75	6 90	10 B	20 00	6 66	73 49	2 00	....	77 34	233 18
Nov. 27.	Second and Pitcher...........	7 ft. 8 in.	10 in.	6 33	13 68	6 24	10 M A	20 00	1 50	29 02	2 00	19 24	29 31	127 32
Oct. 6.	Sixth and Cherry.............	6	10 in.	4 99	11 74	11 10	10 B	20 00	1 04	34 67	3 50	1 75	56 33	145 12
Nov. 27.	Twelfth and Michigan........	10 ft. 5 in.	10 in.	8 66	32 34	12 48	10 S	20 00	3 33	37 50	2 50	14 49	95 33	226 63
Dec. 4.	Vinewood and Buchanan.....	9 ft. 9 in.	12 in.	10 94	30 27	12 48	12 St. L.	65 00	3 07	36 42	2 50	....	109 65	270 33
Dec. 5.	Welch and Buchanan	4 ft. 2 in.	10 in.	3 45	26 09	8 32	10 S	20 00	2 65	30 23	3 50	2 27	50 13	146 64
Oct. 10.	Woodward and N. Boulevard.	13	12 in.	15 10	29 82	19 40	12 St. L.	65 00	4 24	49 59	4 50	2 85	140 09	330 59
Nov. 13.	Woodward and Martin pl...	8 ft. 6 in.	8 in.	5 45	9 41	6 22	8 D W	13 75	95	36 48	4 00	3 11	48 07	127 44

The following is a statement of work of the men employed in the examinations, operations and repairs of gates, gate-wells, gate boxes, etc.:

6,340 gates were examined.
328 gates were out of order Jan. 1st, 1899.
460 gates were out of order since Jan. 1st, 1899.
448 gates were repaired.
81 gates were fitted with larger heads to stem.
9 gates were found shut and opened.
74 gate wells were built over gates on new lines.
445 gate wells were built over gates on old lines.
20 gate wells were enlarged.
72 gate wells and covers were repaired and adjusted to grade.
106 gate wells were cleaned.
10 wood boxes were replaced with iron boxes.
164 boxes were readjusted to grade of street.
8,551 blow-offs were operated for blowing off dead ends.
1,624 gates were shut and opened for flushing.
6,340 gates were shut and opened for various purposes.
55 blow-offs were repaired.

Total and average cost of wells built over gates in old lines:

	Total Cost.	Average Cost.
1 gate well over 42″ gate	$ 108 69	
1 gate well over 24″ gate	58 62	
53 gate wells over 10″-12″-16″ gates	1,814 62	$34 24
387 gate wells over 4″-6″-8″ gates	9,327 13	24 10
2 meter wells	76 48	38 24
1 drain well	....	41 39

Total and average cost of wells built over gates in new lines:

	Total Cost.	Average Cost.
1 gate well over 12″ gate	$ 44 66	
73 gate wells over 4″-6″-8″ gates	1,422 62	$20 17

Total cost of 519 gate wells, $12,944 21.

Repairing Leaks.

The severity of last winter caused numerous breaks in the small mains, the frost in many places penetrating to a greater depth than the pipes are laid. Fearing that the larger mains might also suffer, by authority of the Committee on Extensions, five extra emergency night watches (of two men each) were established and maintained until the frost had left the ground. One of the watches was stationed at the main office, and four at the outlying Police Patrol Stations. The Honorable Police Commissioners kindly permitted our men to be quartered at the several stations—Elmwood Avenue, Canfield Avenue, Scotten Avenue, and Vinewood Avenue—and also assisted them in reaching any reported break in the mains during the night.

About the middle of April, the 42-inch main at Jefferson and Meldrum avenues burst, during noon hour. A large amount of pavement and street car tracks was damaged and the cellars in the vicinity temporarily flooded. The shut-off was very quickly made, however, and further damage prevented.

About a week later, the 30-inch main in Mullett street at the corner of Riopelle was found to be broken, but was discovered in time to prevent any damage other than taking out a full length of pipe.

The cost of repairing the breaks in these two mains, exclusive of repaving, was respectively $336.11 and $187.46.

STATEMENT OF LEAKS, COMPLAINTS, ETC., FOR 1899.

MONTHS.	LEAKS.			COMPLAINTS.				SHUT.				LET ON.			
	In Mains.	In Service Pipe.	False Reports	No Water.	Bad Water.	Short Supply	Water Running.	Vacant	Non-payment.	For Leak.	Miscellaneous	Vacant Re-occupied.	Non-payment.	New.	Miscellaneous
January	3	43	15	7	3	7	5	24	18	60	6	12	5	......	3
February	10	258	......	29	1	3	15	22	4	160	9	14	2	......	14
March	17	134	27	7	4	3	......	14	17	56	5	9	3	......	12
April	5	84	19	6	2	4	8	14	......	40	8	9	2	1	10
May	5	69	16	10	2	9	......	9	8	23	2	1	......	......	11
June	6	47	11	12	8	11	......	16	3	26	1	4	1	......	13
July	6	37	9	8	7	2	......	11	12	6	7	......	......	......	12
August	6	42	9	5	16	4	......	3	6	13	6	6	2	......	8
September	7	32	1	1	5	4	......	2	1	18	8	1	......	......	8
October	7	34	8	2	1	2	......	11	13	11	16	1	5	......	10
November	3	26	20	4	3	2	......	10	24	14	9	4	5	1	8
December	2	25	28	1	2	5	......	26	1	36	13	2	....	2	4
Total	77	831	168	92	54	56	28	162	102	458	90	63	25	4	103

PIPE LAID IN 1899.

Date.	LOCATION OF PIPE.	Feet	Size.	COST OF CONSTRUCTION.												
				Pipe.	Advertising.	Specials.	Lead.	Gates. No.	Gates. Cost.	Sundries.	Gate-wells.	Hauling.	Repaving	Sup. & Eng.	Labor.	Total Cost.
Nov. 8	Aberle st., from 271 ft. w. of w. to 5 ft. w. of e. of Private Way e. of Russell.	296	4 in.	$82 94	....	$3 18	$12 48	1	$6 50	$ 81	$18 57	$4 50	....	$14 95	$74 50	$218 43
July 3	Antoinette st., from 35 ft. w. of e. to 2 ft. e. of e. of 18th st.	37	6 in.	14 04	....	....	2 08	1	9 75	14	22 81	2 00	....	....	24 01	74 88
Aug. 26	Arthur ave., 478 ft. s. of s. from 19 ft. w. of e. of Woodward. (H. P.)	80	6 in.	38 90	....	3 25	5 20	....	....	41	....	6 50	....	4 00	48 00	106 26
Aug. 26	Arthur ave., 4 ft. s. of s. from 19 ft. w. of e. to 4 ft. e. of w. of Woodward. (H. P.)	77	8 in.	53 87	....	5 74	7 80	....	....	67	....	8 50	....	3 85	49 50	129 93
June 22	Bacon st., from 289 ft. e. of e. of West End ave. to 411 ft. e. of e. of same. (Delray)	122	4 in.	30 36	....	....	3 00	....	....	20	....	5 00	....	6 15	22 69	67 40
Oct. 19	Bellevue ave., from 46 ft. s. of n. to 488 ft. n. of n. of Strong. (Hamtramack).	534	6 in.	250 09	....	10 82	20 80	2	16 25	1 70	19 82	10 00	....	26 55	100 72	456 75
Nov. 13	Belvidere, from 216 ft. s. of s. of Gratiot to 294 ft. s. of s. of same	76	6 in.	35 67	....	2 85	4 16	....	....	17	....	4 00	....	3 84	16 57	67 26
Aug. 24	Beresford, 193 ft. s. of from 16 ft. w of e. to w. line of Woodward. (H. P.)	84	8 in.	53 86	....	6 86	7 80	....	....	60	....	6 50	....	4 18	48 00	127 80
May 11	Berlin st., crossing w. side of Jos. Campau	33	6 in.	14 04	....	1 11	1 84	....	....	20	....	3 50	....	......	14 65	35 34
Oct. 2	Buena Vista ave., from 345 ft. to 133 ft. w. of w. of Oakland ave. (H. P.)	212	6 in.	100 03	....	3 14	10 40	....	....	99	....	6 50	....	10 70	55 64	187 40
July 6	Boston Boulevard (n. side), from 3 ft. 6 in. w. of e. of Woodward to 40 ft. e. of w. of Brush	1,763	6 in.	1,375 14	....	54 47	95 92	10	72 00	9 12	102 39	57 50	....	176 45	1,026 37	2,969 36
July 10	Boston Boulevard (s. side), from 4 ft. 6 in. w. of e. of Woodward to 40 ft. e. of w. of Brush.	1,765	6 in.													
July 10	Boston Boulevard for Park Board	201	2 in.	33 16	....	27 72	8 32	5	27 50	1 24	......	5 50	....	....	54 38	157 82
July 10	Boston Boulevard for Sprinkler	12	4 in.	2 76	....	4 81	....	1	5 50	1 08	....	2 00	....	....	2 80	18 95
July 10	Brush st., from 3 ft n. of s. to 3 ft. s. of n. of Boston Boulevard	146	6 in.	56 94	....	6 13	8 92	1	9 75	37	31 09	1 50	......	7 30	36 15	153 15
July 6	Brush st., crossing Marston	39	8 in.	19 44	....	9 85	4 16	1	9 75	88	20 79	3 30	....	....	30 62	98 29
Sept. 9	Brush st., crossing Philadelphia	49	8 in.	30 78	....	4 36	2 25	....	....	12	....	2 50	....	2 40	15 08	57 49
May 9	Charlevoix, crossing Jos. Campau	73	6 in.	28 08	....	6 82	3 68	1	9 75	58	....	5 50	....	....	40 90	95 31

Aug. 30	Church st., from main to w. line of Woodward. (H. P.)	75	10 in.	69.83	......	9 53	7 80	....	......	57	....	7 50	......	3 70	46 65	145 58
May 11	Commonwealth ave., from 15 ft. s. of n. of Hancock to 3½ ft. n. of s. of Putnam	816	6 in.	318 72	18 91	8 52	25 76	2	19 50	2 11	39 62	12 50	....	40 80	221 85	708 29
Aug. 4	Davison ave., 101 ft. n. of from 16 ft. w. of e. to w. line of Woodward. (H. P.)	84	6 in.	38 90	....	5 91	6 50	....	....	49	......	6 50	....	4 20	48 00	110 50
Sept. 15	Ellery st., from 30 ft. n. of s. of Forest to 25 ft. s. of n. of Garfield	417	6 in.	194 51	17 54	7 09	15 60	2	16 25	3 54	41 09	6 50	3 10	20 85	136 37	462 44
Aug. 24	Elmhurst ave., from 17 ft. w. of e. to 2 ft. w. of w. of Woodward. (H. P.)	85	6 in.	38 90	....	31	5 20	....	....	57	....	3 50	....	4 25	48 00	100 73
May 13	Euclid ave., from 18 ft. e. of e. of Hamilton Boulevard to 695 ft. e. of e. of same	677	6 in.	266 76	16 72	5 26	20 24	2	15 25	1 04	19 26	11 50	....	33 85	144 30	534 18
Aug. 23	Fairview ave., from 16 ft. w. of e. of Woodward to 1 ft. w. of w. (H. P.)	85	6 in.	38 90	....	31	5 20	....	....	60	....	6 50	......	4 25	48 00	108 76
Apr. 7	Ferdinand ave., from 27 ft. s. of n. of Porter to 38 ft. s. of n. of Fort	1,733	6 in.	673 52	17 54	13 42	57 04	2	21 20	2 78	43 95	22 50	... ...	86 35	361 32	1,299 62
May 25	Fifth ave., from 25 ft. s. of n. of Stanley to 12 ft. s. of n. of Holden ave.	972	6 in.	379 08	14 16	11 38	34 96	2	19 50	2 08	38 36	12 50	....	48 60	317 75	878 37
Oct. 14	Forest ave., from 12 ft. w. of e. of Cadillac to 26 ft. e. of w. of Pennsylvania	383	6 in.	177 84	3 77	2 52	15 60	1	9 75	1 20	20 15	5 00	....	19 13	79 79	334 75
June 3	Frontenac ave., from 25 ft. n. of s. of Hyde to 26 ft. n. of s of Lambert	298	6 in.	117 00	8 06	6 30	7 36	1	9 75	75	21 91	8 00	....	14 95	37 62	231 70
Aug. 24	Garland ave., from 42 ft. s. of n. of Jefferson ave. to 15 ft. n. of s. of Kercheval. (Grosse Pointe)	1,158	6 in.	539 08	....	11 24	46 80	2	19 50	2 57	37 59	11 50	....	57 90	179 39	905 57
Sept. 2	Garland ave., (alley e. of) from 15 ft. n. of s. of Kercheval to 43 ft. n. of s. of Mack. (Grosse Pointe)	3,823	6 in.	1,772 84	....	14 01	137 80	4	39 00	6 89	78 85	31 19	....	191 15	1,051 33	3,323 06
Aug. 24	Gerald ave., 95 ft. n. of from 16 ft. w. of e. to 2 ft. e. of w. of Woodward. (H. P.)	82	6 in.	38 90	....	2 83	5 20	....	....	56	......	6 50	....	4 08	48 00	106 07
Oct. 10	Gilbert pl., from w. line of Hamilton Boulevard to 5 ft. w. of e. of Wilson ave.	1,715	6 in.	794 72	15 74	3 91	72 80	3	29 25	3 12	60 88	18 00	....	85 70	434 75	1,518 87
Sept. 2	Glendale ave., from 17 ft. w. of e. of Woodward to 6 ft. e. of w. of same, (lowered). (H. P.)	77	6 in.	....	....	9 26	4 50	....	....	56	....	4 50	..... .	....	57 25	76 07
Sept. 8	Grant st., from 28 ft. e. of w. of Wabash to 20 ft. e. of w. of 13th	394	6 in.	183 40	16 72	10 35	22 10	2	15 25	98	37 24	8 50	....	19 50	99 24	418 28
Sept. 28	Grand ave., from 331 ft. w. of w. to 2366 ft. w. of w. of Woodward. (H. P.)	2,035	6 in.	944 77	....	10 29	78 00	....	....	3 32	....	28 50	....	101 75	432 67	1,599 80
Apr. 25	Greusel st., from 50 ft. n. of s. of Michigan to 2 ft. s. of n. of Julia	485	6 in.	184 08	19 16	13 09	16 56	2	19 50	1 34	17 94	12 50	....	23 60	153 74	461 51

PIPE LAID IN 1899—CONTINUED.

Date.	LOCATION OF PIPE.	Feet.	Size.	COST OF CONSTRUCTION.												
				Pipe.	Advertising.	Specials.	Lead.	Gates.		Sundries.	Gate-wells.	Hauling.	Repaving	Sup. & Eng.	Labor.	Total Cost.
								No.	Cost.							
Oct. 4	Hancock ave., from 158 ft. e. of e. to 1 ft. w. of e of Dequindre	158	6 in.	$ 72 25	$ 13 62	$ 3 77	$ 5 20	....	......	$ 38	....	$ 4 50	....	$ 7 70	$ 26 69	$ 134 11
Aug. 3	Homestead pl., from 3 ft. w. of e. of alley e. of St. Aubin to 8 ft. e. of w. of alley w. of Dubois	192	4 in.	44 16	....	8 33	6 08	2	$ 11 00	40	......	22 35	....	....	47 28	139 60
July 3	Hudson ave., crossing 18th	45	6 in.	18 72	....	5 41	6 24	1	9 75	28	21 68	1 50	......	......	30 43	94 01
June 21	Hyde st., from 23 ft., e. of w. of Helen ave. to 23 ft. e. of w. of Frontenac	499	6 in.	196 56	13 97	4 26	14 72	1	9 75	1 29	23 35	10 50	....	24 95	85 35	384 70
June 30	Jefferson ave., (alley s. of) from 151 ft. e. of e. to 184 ft. e. of e. of Bates.	34	4 in.	6 96	....	6 56	2 40	....	....	......	......	1 50	....	......	8 63	25 99
May 27	John R., (alley e. of) from 26 ft. s. of n. of Brady st. to 2 ft. n. of s. of Alexandrine	938	4 in.	215 28	....	7 06	16 56	2	11 00	1 42	43 18	4 50	......	46 90	143 76	489 66
Sept. 7	Kellogg pl., (2d alley s. of Palmer) from 14 ft. w. of e. of alley e. of St. Aubin to w. line of alley w. of Dubois.	184	4 in.	52 44	....	5 88	10 40	2	11 00	89	23 97	6 00	....	9 20	34 31	154 09
Aug. 24	Kercheval ave., from 24 ft. w. of e. of Garland to 44 ft. e. of w. of St. Clair. (Grosse Pointe)	340	8 in.	365 64	....	10 76	0 80	....	....	1 17	......	11 50	....	17 00	69 36	496 23
May 20	Kirby ave., from 20 ft. w. of e. of Riopelle to 143 ft. e. of e. of same	163	6 in.	64 74	4 98	9 99	6 05	1	19 50	56	20 89	1 74	....	8 30	28 13	164 88
Aug. 25	La Martine pl., 108 ft. s. of s. from main to w. line of Woodward. (H.P.)	80	6 in.	38 90	....	3 25	5 20	....	....	37	......	6 50	....	3 95	48 00	106 17
Aug. 25	La Martine pl., 155 ft. n. of n. from main in Woodward to 2 ft. w. of w. (H. P.)	81	6 in.	38 90	....	3 25	5 20	....	....	48	....	6 50	....	4 05	48 00	106 38
May 8	Leland, crossing St. Antoine from 8 ft. e. of w. to 8 ft. w. of e. of same	39	6 in.	14 04	......	5 39	5 52	2	19 50	55	....	2 50	......	....	36 70	84 20
May 22	Lyman st., from 2 ft. w. of w. to 190 ft. w. of w. of Chene	186	6 in	74 88	16 89	7 53	5 52	1	5 50	39	20 87	2 50	....	9 30	27 27	170 65
Aug. 23	Marjorie ave., from 16 ft. w. of e. to 1 ft. w. of w. of Woodward. (H. P.)	85	6 in.	38 90	....	31	5 20	....	....	49	....	6 50	....	4 25	48 00	103 65
Oct. 31	McDougall Boulevard, from 39 ft. n. of s. to 66 ft. s. of s. of N. Boulevard	107	12 in.	121 20	....	18 24	14 20	1	65 00	3 01	44 66	5 50	....	5 20	162 55	439 56
Sept. 13	Melbourne ave., from 44 ft. e. of e. of Brush to 28 ft. e. of w. of Oakland	1,231	8 in.	892 58	18 26	25 43	72 50	3	41 25	2 20	57 66	20 50	....	61 50	328 99	1,521 17

Nov. 18	Milwaukee ave., from 25 ft. w. of e. to w. line of 16th	35	6 in.	16 67	....	32	1 80	.. .	....	34	19 05	1 00	......	1 70	7 78	48 66
July 11	Monroe ave., for Palmer Memorial Fountain	136	4 in.	33 12	....	6 22	6 24	1	5 50	1 29	....	5 00	31 46	....	109 64	198 47
Aug. 19	Monterey, 320 ft. n. of from 17 ft. w. of e. to w. line of Woodward. (H. P.)	83	6 in.	38 90	....	7 13	5 20	....	....	60	....	6 50	....	4 15	48 00	110 48
Aug. 25	Monterey ave., from 16 ft. w. of e. to w. line of Woodward. (H P.)	86	6 in.	44 46	....	6 10	7 80	....	....	71	....	6 50	....	4 33	48 C0	117 90
Nov. 14	N. Boulevard, from 26 ft. w. of e. of 16th to 26 ft w. of e. of Stanton	388	6 in.	183 40	7 16	10 65	14 56	1	9 75	1 11	21 54	4 50	....	19 40	66 10	338 17
Sept. 22	N. Boulevard, from 188 ft. w. of w. of Dequindre to 3 ft. 6 in. w. of e. of Orleans	63	8 in.	38 48	....	......	5 20	....	....	35	....	3 50	....	3 15	16 87	67 55
Sept. 13	Oakland ave., from 19 ft. s. of n. of Westminster ave. to :05 ft. n. of n. of same	224	10 in.	189 52	16 99	7 97	15 60	1	5 50	55	....	10 50	....	11 25	41 65	299 53
Sept. 22	Orleans st., from 96 ft. s. of n. to 3 ft. s. of n. of N. Boulevard	93	8 in.	58 72	....	1 89	4 83	1	6 50	28	21 71	1 50	....	4 65	17 88	117 96
Sept. 23	Orleans st, from 3 ft. s. of n. to 504 ft. n. of N. Boulevard	507	8 in.	318 33	....	16 32	26 37	....	....	1 41	....	10 00	....	25 20	125 66	523 29
Sept. 6	Otis st., from 106 ft. w. of w. of 31st to 18 ft. e. of w. of same	124	6 in.	61 13	4 96	2 84	7 80	1	9 75	54	18 68	5 50	....	6 20	31 31	148 71
July 3	Palmer ave., crossing St. Aubin	49	6 in.	18 72	....	5 41	6 24	1	9 75	50	....	2 00	....	....	24 68	67 30
Aug. 29	Palmer Park ave., from 20 ft. w. of e. to 2 ft. w. of w. of Woodward. (H.P.)	82	6 in.	38 90	....	4 37	6 50	....	....	41	....	6 50	....	4 05	48 00	108 78
Aug. 30	Palmer Park ave., 293 ft. n. of n. (Kemto) from main to w. line of Woodward. (H. P.)	74	6 in.	38 90	....	4 37	5 20	....	....	38	....	6 50	....	3 70	48 00	107 05
Aug. 30	Palmer Park ave., 660 ft. n. of n. from main to w. line of Woodward	74	8 in.	53 87	....	7 92	7 80	....	....	53	....	6 50	....	3 70	46 34	126 66
Sept. 8	Parker ave., from 528 ft. to 635 ft. n. of n. of Mack ave	107	6 in.	50 17	16 77	2 84	5 20	....	....	32	....	5 50	....	5 35	19 12	105 27
May 15	Pennsylvania ave., from 1058 ft. n. of n. of Kercheval to 1609 ft. n. of n. of same	551	6 in.	215 28	17 54	11 97	14 72	1	5 50	1 02	....	13 50	....	27 60	111 04	418 17
Oct. 14	Pennsylvania ave., from 47 ft. n. of n. of Elsa to 22 ft. s. of n of Forest	1,478	6 in.	683 57	14 58	16 29	56 20	2	19 50	2 92	59 29	14 00	....	73 90	289 21	1,229 46
Sept. 9	Philadelphia ave., from 12 ft. e. of w. of Brush to 21 ft. e. of w. of Oakland	1,314	6 in.	611 32	17 27	4 04	47 00	3	29 25	2 68	59 26	19 00	......	65 70	443 25	1,299 07
Oct. 4	Piquette ave., from e. line of St. Aubin to 19 ft. e. of w. of Dubois	433	6 in.	200 07	14 30	4 80	20 80	1	9 75	1 17	40 18	4 50	....	21 65	127 54	444 85
Nov. 8	Private Way, (e. of Russell) from 27 ft. n. of s. of Aberle to 80 ft. s. of s. of same	107	6 in.	50 17	....	16 56	8 32	3	22 75	4 85	....	6 50	....	5 35	48 43	162 93

PIPE LAID IN 1899—CONTINUED.

Date.	LOCATION OF PIPE.	Feet	Size.	COST OF CONSTRUCTION.												
				Pipe.	Advertising.	Specials.	Lead.	Gates.		Sundries.	Gatewells.	Hauling.	Repaving	Sup. & Eng.	Labor.	Total Cost.
								No.	Cost.							
Mar. 8	Pumping Works grounds, connection for sprinkler s. w. corner of grounds	113	4 in.	$ 25 23	....	$ 18 98	$ 7 36	2	$ 11 00	$ 80	$ 30 69	$ 4 50	....	$ 8 05	$ 116 58	$ 223 49
Mar. 16	Pumping Works grounds, laid 4-in. water pipe around n. Lavatory w. side grounds	37	4 in.													
Mar. 16	Pumping Works grounds, connection for sprinkler w. side of grounds.	11	4 in.													
Apr. 21	Pumping Works grounds, on embankment between settling basin and canal	987	2 in.	88 33	....	1 26	7 36	....	....	87	....	2 50	....	....	172 25	272 57
May 18	Pumping Works grounds, 2-in. water pipe from 6-in. main to Hurlbut Library	184	2 in.	16 83	....	23 71	13 23	....	....	28	....	4 50	....	....	62 25	120 80
June 22	Reid ave., from 144 ft. s. of s. of to 22 ft. s. of s. of Hesse. (Delray)	122	4 in.	30 36	....	....	3 00	....	....	20	....	5 00	....	6 15	22 69	67 40
May 3	Richard st., from 5 ft. 6 in. w. of e. of Seyburn to 27 ft. w. of e. of Van Dyke	615	6 in.	238 68	$ 17 27	9 73	22 08	1	9 75	2 46	25 43	9 50	$ 3 30	30 75	174 35	543 30
May 20	Riopelle st., from 25 ft. s. of n. of Ferry to 25 ft. n. of s. of Kirby	434	6 in.	169 26	13 60	18 71	16 03	1	5 50	90	14 83	5 76	....	21 90	95 74	362 23
May 15	Rose st., (alley s. of) from 18 ft. w. of e. of 20th to 5 ft. w. of e. of alley e of same	197	4 in.	46 92	....	6 21	9 28	1	5 50	1 03	20 80	4 00	....	9 85	93 13	196 72
Nov. 16	Sixteenth st., from 3 ft. n. of s. of N. Boulevard to 100 ft. s. of s. of Milwaukee	527	6 in.	244 54	9 56	12 73	18 72	2	16 25	2 35	18 90	7 50	....	26 25	172 69	529 49
Mar. 27	Solvay Process Co., extending 12-and 10-in. mains to pump house. (Delray)	221	10 in.	103 60	....	18 62	18 40	1	15 00	4 03	....	6 50	....	11 05	91 93	269 13
		228	12 in.	143 60	....	61 06	25 48	1	20 00	8 98	....	7 50	....	11 40	117 75	395 77
May 23	Stanley ave., from e. line of Greenwood to 25 ft. w. of e. of 5th	277	6 in.	107 64	5 26	4 00	9 20	....	....	65	19 20	9 50	....	13 90	78 69	248 04
May 13	St. Antoine, at connection with Willis.	5	6 in.	2 02	....	1 01	78	....	....	15	......	25	....	....	3 23	7 44
Aug. 24	St. Clair ave., from 40 ft. s. of n. of Jefferson to 15 ft. n. of s. of Kercheval. (Grosse Pointe)	1,127	6 in.	522 41	....	8 48	41 60	2	19 50	4 41	37 61	11 00	....	56 40	180 08	881 44
Nov. 10	Storage Yard, along n. side of main drive-way	71	4 in.	18 55	....	6 66	4 80	1	6 50	40	22 69	....	....	3 40	24 79	87 79

Nov. 10	Storage Yard, along n. side of main drive-way..........................	147	2 in.	28 80	....	2 64	1 40	...	....	24	....	....	....	7 30	34 72	75 10
Apr. 25	Superior st., from 4⅛ ft. e. of e. of Russell to 4 ft. w. of w. of Riopelle..	441	6 in.	172 36	22 99	4 90	14 72	...	....	4 10	36 00	3 50	....	22 10	110 04	390 71
Sept. 20	Sylvester st., from 25 ft. w. of e. of Van Dyke to 570 ft. e. of e. of same..	595	6 in.	272 87	16 44	14 10	26 00	3	15 25	1 00	19 37	10 60	....	29 83	126 79	532 25
Sept. 6	Thirty-first st., from 18 ft. n. of s. of Otis to 20 ft. n. of s. of Ingersoll..........	339	6 in.	155 61	13 13	5 82	15 60	1	9 75	83	18 55	9 50	....	16 85	71 63	317 27
May 15	Twentieth st., (alley e. of) from 6 ft. s. of n. of alley s. of Rose to 175 ft. s. of s. of Rose..........................	108	4 in.	22 08	....	1 27	3 60	...	....	69	....	3 00	....	4 90	46 59	82 13
Sept. 16	Twenty fifth st., from 27 ft. s. of n. to 13 ft. n. of s. of Lafayette.	20	6 in.	11 12	....	9 59	5 20	1	9 75	35	15 21	5 00	....	1 03	16 56	73 81
Apr. 8	Warren ave., from 11 ft. e. of e. of Collins to 187 ft. e. of e. of same.....	176	6 in.	70 20	16 44	2 52	7 36	1	5 50	93	22 98	2 00	....	8 80	20 05	156 78
May 13	Willis ave., crossing St. Antoine... ..	30	6 in.	12 02	....	6 07	4 74	1	9 75	92	....	1 75	3 50	....	19 40	58 15
Aug. 29	Willow ave., from 21 ft. w. of e. to 3 ft. w. of w. of Woodward. (H. P.)...	84	6 in.	38 90	....	1 43	5 20	...	....	38	....	6 50	....	4 20	48 00	104 61
June 19	Winder st., from 43 ft w. of e. to 314 ft. e. of e. of Woodward............	379	8 in.	207 36	.....	35 48	24 96	1	13 75	2 23	24 09	21 00	11 47	19 00	219 60	578 94

All of which is respectfully submitted,

LUKE CROSSLEY,

Superintendent of Construction.

REPORT OF THE SUPERINTENDENT OF GROUNDS.

To the Board of Water Commissioners of the City of Detroit:

Gentlemen—In submitting my annual report on the condition of the grounds at the Pumping Works, I beg to say that during the year the grounds have been kept in a very attractive condition and have been visited by many thousands of people, not only of our own city, but from all parts of the world, and there have been constant expressions of appreciation for the beauties of the park. The floral work has been universally admired, especially the patriotic pieces, so appropriate last year, such as the American flag, the old fort and remembrance motto to fallen soldiers; also the clock, which kept perfect time, the daily calendar, and the fraternal mottoes, appropriate to the large conventions of fraternal societies held in the city during the summer.

The summer was one of unusual drought, requiring a great amount of labor to keep the flowers and grass in proper shape. This work was well taken care of under the direction of Mr. Dunnebacke.

The erection of toilet rooms and drinking fountains has added very greatly to the convenience and comfort of the public.

The foot-bridge to Central Island is unique in design and convenient in position, giving access to the enjoyment of this beautiful spot. I would suggest that large flower vases be placed on the foot piers of the bridges.

A large amount of work was done in the shape of regrading and sodding the grounds on the west side of Central

Road to the drawbridge, also making roads on both sides of the new carriage bridge; also in the planting of trees and shrubs.

It is recommended that the grounds on southwest side of new bridge, from the first toilet building to the river front, be regraded so as to correspond with the grade of the work just completed.

The absolute need of the new greenhouse has been demonstrated and plants can now receive proper care.

I would recommend that a new fountain be placed in the east lake and the old spray fountain removed. This would improve the circulation and keep the water in a more pure condition.

The system of drainage completed in the spring has greatly improved the condition of the grounds.

The wood-work of the clock mound has become so decayed as to make it unsafe, and I recommend that it be replaced with brick.

Respectfully submitted,

WILLIAM PLUMMER,
Superintendent of Grounds.

SUPPLEMENT.

BOARD OF MANAGEMENT OF DETROIT WATER WORKS.

Board of Trustees appointed by Common Council, February 24th, 1852; organized March 1st, 1852.

Shubael Conant, Chairman. Edmund A. Brush.
Henry Ledyard. Wm. R. Noyes.
Jas. A. Van Dyke.

1853.

On the 16th of May, 1853, the Board of Water Commissioners of the City of Detroit was organized under an act previously approved by the Common Council and passed by the Legislature, February 14th, 1853. The term of service was determined by lot, as follows:

Jas. A. Van Dyke,	for 3 years.
Edmund A. Brush,	for 4 years.
Henry Ledyard,	for 5 years.
Shubael Conant,	for 6 years.
Wm. R. Noyes,	for 7 years.

Shubael Conant was elected President, who, finding the duties too arduous, resigned July 30th, and Edmund A. Brush was elected.

1854.

Edmund A. Brush, President. Jas. A. Van Dyke.
Shubael Conant. Wm. R. Noyes.
Henry Ledyard.

1855.

Edmund A. Brush, President.
Henry Ledyard.
Shubael Conant.
William R. Noyes.
James A. Van Dyke, died May 8th.

A. D. Fraser, appointed to fill vacancy.

1856.

Edmund A. Brush, President.
Shubael Conant.
Wm. R. Noyes.
Alexander D. Fraser, re-appointed May 1st, for 5 years.
Henry Ledyard.

1857.

Edmund A. Brush, President, re-appointed May 1st, for 5 years.
Henry Ledyard.
Alexander D. Fraser.
William R. Noyes.

Shubael Conant.

1858.

Edmund A. Brush, President.
Shubael Conant.
Alexander D. Fraser.
Henry Ledyard, re-appointed May 1st, for 5 years.
Wm. R. Noyes.

1859.

Edmund A. Brush, President.
Alexander D. Fraser.
Wm. R. Noyes.
Shubael Conant, term expired May 1st, and
Julius D. Morton, appointed for 5 years.
Henry Ledyard, vacated by moval from city, and
John V. Ruehle, appointed May 1st to fill vacancy.

1860.

Edmund A. Brush, President.
Alexander D. Fraser.
Julius D. Morton.
William R. Noyes, re-appointed May 1st, for 5 years.
John V. Ruehle.

1861.

Edmund A. Brush, President.

Alexander D. Fraser, re-appointed May 1st for 5 years.

Jno. V. Ruehle, resigned Sept. 16th, and

Chauncey Hurlbut appointed to fill vacancy.

1862.

Edmund A. Brush, President, re-appointed May 1st, for 5 years.

Wm. R. Noyes.

Julius D. Morton.

Chauncey Hurlbut.

Alexander D. Frazer.

1863.

Edmund A. Brush, President.

Alexander D. Frazer.

Wm. R. Noyes.

Julius D. Morton.

Chauncey Hurlbut, term expired May 1st, and

Stanley G. Wight, appointed for 5 years.

1864.

Edmund A. Brush, President.

Alexander D. Frazer.

Wm. R. Noyes.

Julius D. Morton, term expired May 1st.

Stanley G. Wight.

1865.

Edmund A. Brush, President.

Wm. R. Noyes, resigned Jan. 10, and Jacob S. Farrand appointed to fill vacancy, Term expired May 1st. Re-appointed for 5 years.

Alexander D. Frazer.

Stanley G. Wight.

Julius D. Morton, re-appointed for 5 years from May 1st, 1864. Died Feb. 1865, and

Jno. Owen appointed to fill vacancy.

1866.

Edmund A. Brush, President.

Alexander D. Fraser, re-appointed May 1, for 5 years.

Stanley G. Wight.

Jacob S. Farrand.

Jno. Owen.

1867.

Edmund A. Brush, President, re-appointed May 1, for 5 years.
Alexander D. Fraser.
Jacob S. Farrand.
Jno. Owen.
Stanley G. Wight.

1868.

*Edmund A. Brush, President.
Stanley G. Wight, term expired May 1, and
Chauncey Hurlbut appointed for 5 years.
Jacob S. Farrand.
John Owen.
Caleb Van Husan.

*Edmund A. Brush resigned January 28, and Caleb Van Husan appointed to fill vacancy, and Alexander D. Fraser elected President.

1869.

Alexander D. Fraser, President.
John Owen, re-appointed May 1, for 5 years.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.

1870.

Alex. D. Fraser, President.
Jacob S. Farrand, re-appointed May 1, for 5 years.
Jno. Owen.
Caleb Van Husan.
Chauncey Hurlbut.

1871.

*Alex. D. Fraser, President.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.
John Owen.

*Term expired May 1, and Samuel F. Hodge appointed for 5 years. Jacob S. Farrand elected President.

1872.

Jacob S. Farrand, President.
Jno. Owen.
*Caleb Van Husan.
Samuel F. Hodge.
Chauncey Hurlbut.

*Term expired May 1st, and Elija Smith appointed for 5 years.

1873.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed. Elected President, May, 1872.

1874.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re.appointed.

1875.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1876.

Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. *Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1877.

Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
*Michael Martz.

*Elija Smith's term expired and Michael Martz appointed to fill vacancy.

1878.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Michael Martz.

*Term expired and re-appointed.

1879.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
*Jno. Pridgeon.

*Jno. Owen's term expired and John Pridgeon appointed to fill vacancy. Samuel F. Hodge resigned and Jas. Beatty appointed to fill vacancy.

1880.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1881.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1882.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1883.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1884.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
*Jno. Pridgeon.

*Term expired, and Marshall H. Godfrey appointed

1885.

*Jacob S. Farrand, President. Michael Martz.
Marshall H. Godfrey. *Edwin F. Conely.
*Samuel G. Caskey.

*Jas. Beatty died and Edwin F. Conely appointed to fill vacancy.
*Chauncey Hurlbut died and Samuel G. Caskey appointed to fill vacancy.
*Jacob S. Farrand's term expired and re-appointed.

1886.

Jacob S. Farrand, President. Michael Martz.
Marshall H. Godfrey. *Jno. Pridgeon.
Samuel G. Caskey.

*Edwin F. Conely's term expired and Jno. Pridgeon appointed to fill vacancy.

1887.

Jacob S. Farrand, President. Jno. Pridgeon.
Marshall H. Godfrey. Samuel G. Caskey.
*Joseph Nagel.

*Michael Martz term expired and Joseph Nagel appointed to fill vacancy.

1888.

Jacob S. Farrand, President. Jno. Pridgeon.
Marshall H. Godfrey. *Samuel G. Caskey.
Joseph Nagel.

*Term expired and re-appointed.

1889.

Jacob S. Farrand, President. Jno. Pridgeon.
Samuel G. Caskey. Jos. Nagel.
*August Goebel.

*Marshall H. Godfrey resigned January 1, 1889. August Goebel appointed to fil vacancy. Term expired May 1st, and re-appointed.

1890.

Jno. Pridgeon, President. August Goeel.
Joseph Nagel. *Henry M. Duffield.
Samuel G. Caskey.

*Jacob S. Farrand's term expired, and Col. Duffield was appointed to fill vacancy July 9th, 1890; John Pridgeon resigned as President of the Board, on account of ill-health, and Henry M. Duffield was elected to fill vacancy.

1891.

Henry M. Duffield, President. *Jno. Pridgeon.
August Goebel. Samuel G. Caskey.
Joseph L. Hudson.

*John Pridgeon's term expired May 1st, and Frank E. Kirby was appointed for a term of 5 years.

1892.

Samuel G. Caskey, President. Henry M. Duffield.
August Goebel. Joseph L. Hudson.
Frank E. Kirby.

1893.

August Goebel, President. Samuel G. Caskey.
Frank E. Kirby. Henry M. Duffield.
Joseph L. Hudson.

1894.

Henry M. Duffield, President. Frank E. Kirby.
Albert L. Stephens. De Witt H. Moreland.
Edward W. Pendleton.

A. L. Stephens appointed to succeed J. L. Hudson.
D. W. H. Moreland appointed to succeed S. G. Caskey.
Clarence A. Black appointed to succeed August Goebel.
C. A. Black resigned and E. W. Pendleton appointed to succeed him from Dec, 1.

1895.

Frank E. Kirby, President. Albert L. Stephens.
DeWitt H. Moreland. Edward W. Pendleton.
Darius D. Thorp.

1896.

Albert L. Stephens, President.
Edward W. Pendleton.
John P. Huckestein.
Darius D. Thorp.
John W. McGrath.

D. W. H. Moreland resigned to accept Commissionership on Board of Public Works, and J. P. Huckestein was appointed to fill vacancy.

Frank E. Kirby's term expired and J. W. McGrath was appointed to succeed him.

1897.

Edward W. Pendleton, President.
Darius D. Thorp.
James W. Millen.
John W. McGrath.
August Goebel.

August Goebel, appointed to succeed A. L. Stephens. Resigned January 1, 1898, and Joseph J. Noeker was appointed to fill vacancy.

John P. Huckestein resigned and James W. Millen was appointed to fill vacancy.

1898.

Edward W. Pendleton, President.
Joseph J. Noeker.
John W. McGrath.
Darius D. Thorp.
James Meathe.

1899.

Darius D. Thorp, President.
John W. McGrath.
Joseph J. Noeker.
*James Meathe.
Edward W. Pendleton.

*James Meathe died September 21st, 1899, and Benjamin Guiney was appointed to fill vacancy.

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FORTY-SEVENTH

ANNUAL REPORT

OF THE

BOARD OF WATER COMMISSIONERS

WATER WORKS.

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR

1898.

FORTY-SEVENTH ANNUAL REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE CITY OF DETROIT

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1898.

DETROIT FREE PRESS PRINTING COMPANY.
1899.

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THE BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

METER RATES.

	MONTHLY
First 15,000 gals	5 cts. per M.
All over 15,000 gals	1¼ " "
Minimum Rate	75 cts.

Payable Quarterly.

ASSESSMENT RATES.

FROM JANUARY 1st, 1898.

	PER ANNUM
For Family, household purposes	$2 00
Additional Families to first, in same house supplied with one faucet, each	1 00
Green Houses.—Special rates.	
Private Stable, for each horse	1 00
Livery Stables, " " "	1 00
Dray and Team Horses, each	50
Cows, each	50
Stores and Offices, from	$1 25 to 12 00
Bakeries, average daily use for each barrel of flour	2 00
Saloons, Groceries and Provision Stores, from	$2 00 to 50 00
Bar, with faucet, from	6 00 to 50 00
Fish Houses	6 00 to 50 00
Slaughter Houses.—Special rates.	
Hotels and Taverns, in addition to family rate, each room	50
Boarding Schools, from	$3 00 to 50 00
Building Purposes, each 1 M brick	02
" " " 100 yards plastering	05
" " " perch stone	00½
" " " minimum	50
Printing Offices.—Special rates.	
Butcher Stalls, each not less than	2 00
Workshops, for 10 persons or under	2 00
" for each additional 10 persons	1 00
Estimated quantities of water each 1,000 gallons	05
Boarding Houses, in addition to family rate, each boarder or roomer,	60

FIXTURES.

Bath Tub, for families, 1st tub	$1 00
" " each additional tub.	60
" " public, each tub	4 00
Automatic Water Closets, for a family, 1st closet	1 60
" " " each additional	60
" " " for hotels, stores, factories, etc., for 10 persons	2 00
" " " each additional person	20
Rod Water Closets, not less than	6 00
Urinals, not less than	2 00
Wash Hand Basins, for family	50 cts. to 2 00
" " " for other purposes, each person	15
Hose, premises 30 feet front or less	60
" " 30 feet to 60 feet	80
" " 60 feet to 100 feet	1 60
Special Rates for larger grounds.	
Fountains	$5 00 to 20 00
Street Sprinklers, each wagon	50 00

Where there is a waste of water a proper increase of rates will be made.

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT FOR 1898.

MEMBERS:

EDWARD W. PENDLETON, 1899. JOHN W. McGRATH, 1901.
DARIUS D. THORP, 1900. JOSEPH J. NOEKER, 1902.
JAMES MEATHE, 1903.

COMMITTEES:

Ways and Means	Commissioners THORP, MEATHE.
Extension and Construction,	Commissioners McGRATH, THORP.
Pumping Works	Commissioners NOEKER, McGRATH.
Supplies	Commissioners MEATHE, THORP.

The President is ex-officio member of each committee.

OFFICERS:

President	E. W. PENDLETON.
Vice-President	JOHN W. McGRATH.
General Manager	MARSHALL H. GODFREY.
Secretary	H. S. STARKEY.
Superintendent of Construction	LUKE CROSSLEY.
Supt. of Meters and Inspection	THOMAS R. PUTNAM.
Civil Engineer	C. W. HUBBELL.
Chief Engineer at Pumping Works	URIAH GOULD.
Receiving Clerk	GEORGE E. KUNZE.
Cashier	H. J. A. LETEKER.
Assistant Cashier	S. G. ROOD.
Meter Clerk	FRED. H. HUTAFF.
Bookkeeper	ARTHUR V. POTTER.
Permit Clerk	ARTHUR J. STORM.
Collectors	FRANK PETZ T. W. GOODALE. W. W. WILCOX. ANTHONY VOGEL. J. J. ROBINSON. GEORGE ADAMS. M. A. DETTLING. CHARLES M. PRESTON.
Store Keeper	WM. A. BOURKE.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

To the Honorable the Common Council of the City of Detroit:

The Board of Water Commissioners of the City of Detroit respectfully submits herewith its annual report for the year ending December 31st, 1898.

The reports of the heads of departments covering, in detail, the operations of the Board are commended to your careful consideration. The extent and importance of the work accomplished can only be appreciated by a careful examination of the annual reports.

The reduction of one-half in the water rates, taking effect January 1st, 1898, was considered somewhat of an experiment; but it is believed that with careful management the rates as now fixed, which are the lowest, so far as known, in any city in the world, may be permanently maintained.

The amount assessed upon abutting property for new pipe is the sum of $48,832.79. On account of the conditions fixed for the payment of this assessment the Board is obliged to carry this expense until the taxes are finally collected. The experience of the past year has suggested some improvements in the methods of assessment.

The outlay for permanent improvements during the past year, including all pipe extension, has been the sum of $167,422.32. There has been laid in the Village of Delray 68,513 feet of pipe, for which said Village has paid the entire expense, amounting to the sum of $48,550.66. The amount of water pipe already laid outside the City limits amounts to about 163,944 feet, the entire cost of which has been paid by the townships benefited. Whenever this territory shall become a part of the City of Detroit the water pipe extensions will become the property of the Board.

The total amount expended during the year is the sum of $348,476.15, the receipts $387,165.21. The bonded indebtedness is now $1,033,000.00. No bonds have matured during the past year. The sum of $100,000.00 becomes due on September 1st of the current year.

It is gratifying to report that after the most careful analysis the Board of Health finds that the water supply is free from any unwholesome contamination. Examinations were made at frequent intervals and under various conditions. Even when the water was in a roilly condition the analysis indicated that it was perfectly wholesome. A detailed statement of this analysis is found in the General Manager's report.

It is expected that the steamer "Milton D. Ward" will soon be removed from its present location, where it now interferes with necessary work in completion of the sewer system of the Pumping Station Park. Some six years ago this steamer was fitted out as a pest ship and was moored at the Water Works dock. After being partially burned it became liable at any time to sink, blocking the channel and cutting off the approach of coal vessels to the Pumping Station. The Board then hired the privilege of beaching this steamer below the Park. Not content with its new location, this phantom ship found itself one dark night mysteriously driven ashore just off the Park. After years of unsuccessful effort in endeavoring to rid itself of this dangerous nuisance the Board applied to the Court in Chancery, which has finally decreed that it must be removed.

The following spring will show a decided improvement in the Water Works Park. The building formerly used for the storage of oil is being reconstructed for the purpose of containing the Hurlbut Library, and it is expected that a branch of the Public Library may be established at this place. A much needed greenhouse is also well under way, and a permanent improvement at the end of the canal.

There seems to be some misapprehension relative to the method pursued in regard to the tearing up of pavements. For several years this Board has paid for the services of an inspector appointed by and under the control of the Board of Public Works. All repairing of pavements made necessary by work of this Board is under the supervision of this inspector of the Board of Public Works, who do the work, but which is paid for by this Board. This arrangement was made some years ago and was supposed to be entirely satisfactory.

Upon notice from the Common Council, water pipes are laid in all strėets before paving.

Inviting your careful examination of the important trust committed to us, this report is respectfully submitted.

Detroit, January 3rd, 1899.

EDWARD W. PENDLETON,
DARIUS D. THORP,
JOHN W. McGRATH,
JOSEPH J. NOEKER,
JAMES MEATHE,
Commissioners.

REPORT OF THE SECRETARY.

Detroit, January 3, 1899.

To the Board of Water Commissioners of the City of Detroit:

Gentlemen—I have the honor to submit the Secretary's Report for the year ending December 31, 1898.

The following is a detailed statement of the receipts and disbursements:

Receipts.

Water Rates Account.—	
Rates paid	$236.743 13
Percentage Account.—	
From delinquents	4.493 54
Penalties for shutting off	238 00
Plumbers' License Account.—	
Paid for licenses	648 80
Service Connection Account.—	
Service connections	4.696 25
Labor and materials	186 10
City of Detroit Account.—	
Tax levy	73.909 26
Repairing Leaks Account.—	
Labor	39 92
Office Account.—	
Use of telephone	17 00
Iron Pipe Extension Account.—	
W. E. Walsh account, Mack and [illegible] avenues	754 74
Chas. Bewick account, Bewick avenue	726 23
Rowen & Rathbone account, McMillan street	218 45
Rowen & Rathbone account, Anthon street	125 00
Stanton & Lawrence account, Parkview avenue	287 65
G. A. Schuman account, Harper avenue	229 08
Frank A. Lyons account, Strong avenue	182 63
Walsh & Feldman account, Mack and O'Flynn aves	829 80

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FORTY-SEVENTH
ANNUAL REPORT
OF THE
BOARD OF WATER COMMISSIONERS

WATER WORKS.

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR

1898.

Oil	$ 24 92	
Repaving	1,177 10	
Horse expense	113 10	
Cement, sand, brick, gate boxes, wells	2,347 16	
Wagon and harness supplies	181 74	
Packing and waste	174 20	
Paint	68 45	
Street car and toll tickets	95 00	
Horseshoeing	209 09	
Medical services	6 00	
Miscellaneous materials	555 88	
Veterinary services	23 00	
Freight and express	2 42	
Repairing tools, etc	95 91	
Hauling pipe	419 70	
Stationery, books, etc	80 43	
Extra services	119 35	
Advertising laying pipe	1,813 96	
Stop boxes	30 50	
Inspection	956 84	
Frontage assessments refunded	357 45	
Safe	34 00	
Light	68 55	
Rebate	17 36	
Horses	300 00	
		$ 85,625 72

The above account embraces the expense of laying pipe without the city on private account (except Delray), and also the expense of pipe laid under the new law which provides for assessments on abutting property, as follows:

W. E. Walsh, account	$ 796 74
Charles Bewick, account	726 23
Rowen & Rathbone, account	343 45
Stanton & Lawrence, account	387 65
G. A. Semram, account	129 08
Frank A. Lyons, account	182 63
Walsh & Feldman, account	820 80
Assessments on abutting property	1,780 65
Total paid	$ 5,167 23

Balance due for 1897 and 1898, assessments on abutting property as follows:

Engineering
Library
TD
225
D6
A23

FORTY-SEVENTH ANNUAL REPORT

OF THE

BOARD OF WATER COMMISSIONERS

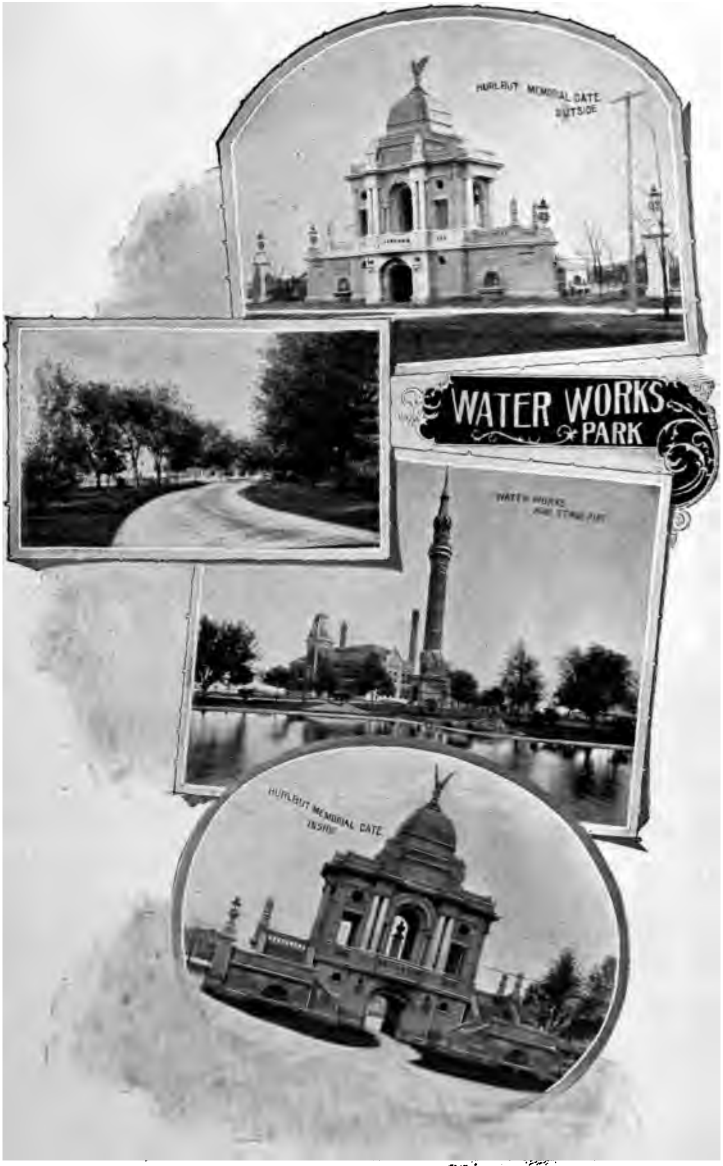
WATER WORKS.

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR

1898.


HURLBUT MEMORIAL GATE OUTSIDE
WATER WORKS PARK
WATER WORKS AND STAND PIPE
HURLBUT MEMORIAL GATE INSIDE

FORTY-SEVENTH ANNUAL REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE CITY OF DETROIT

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1898.

DETROIT FREE PRESS PRINTING COMPANY.
1899.

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THE BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

METER RATES.

	MONTHLY
First 15,000 gals	5 cts. per M.
All over 15,000 gals	1¼ " "
Minimum Rate	75 cts.

Payable Quarterly.

ASSESSMENT RATES.

FROM JANUARY 1st, 1898.

	PER ANNUM
For Family, household purposes	$2 00
Additional Families to first, in same house supplied with one faucet, each	1 00
Green Houses.—Special rates.	
Private Stable, for each horse	1 00
Livery Stables, " " "	1 00
Dray and Team Horses, each	50
Cows, each	50
Stores and Offices, from	$1 25 to 12 00
Bakeries, average daily use for each barrel of flour	2 00
Saloons, Groceries and Provision Stores, from	$2 00 to 50 00
Bar, with faucet, from	6 00 to 50 00
Fish Houses	6 00 to 50 00
Slaughter Houses.—Special rates.	
Hotels and Taverns, in addition to family rate, each room	50
Boarding Schools, from	$3 00 to 50 00
Building Purposes, each 1 M brick	02
" " " 100 yards plastering	05
" " " perch stone	00½
" " " minimum	50
Printing Offices.—Special rates.	
Butcher Stalls, each not less than	2 00
Workshops, for 10 persons or under	2 00
" for each additional 10 persons	1 00
Estimated quantities of water each 1,000 gallons	05
Boarding Houses, in addition to family rate, each boarder or roomer,	60

FIXTURES.

Bath Tub, for families, 1st tub	$1 00
" " each additional tub	60
" " public, each tub	4 00
Automatic Water Closets, for a family, 1st closet	1 60
" " " each additional	60
" " " for hotels, stores, factories, etc., for 10 persons	2 00
" " " each additional person	20
Rod Water Closets, not less than	6 00
Urinals, not less than	2 00
Wash Hand Basins, for family	50 cts. to 2 00
" " " for other purposes, each person	15
Hose, premises 30 feet front or less	60
" " 30 feet to 60 feet	80
" " 60 feet to 100 feet	1 60
Special Rates for larger grounds.	
Fountains	$5 00 to 20 00
Street Sprinklers, each wagon	50 00

Where there is a waste of water a proper increase of rates will be made.

Horse Expense.—

Hay, oats, bran, corn	$ 970 96	
Shavings and bedding	50 00	
Barn rent	32 00	
Repairs	26 80	
Sundry supplies	84 89	
		$ 1,164 65

RECAPITULATION.

Construction expenditures	$118,861 66
Operation expenditures	79,823 87
Maintenance expenditures	16,916 53
Per centage account	2,540 00
Service connection account	7,007 36
Hurlbut Fund	2,695 09
Delray village	48,560 66
Interest account	69,520 00
Horse and wagon account	14 85
Real estate account	1,371 48
Horse expense account	1,164 65
Total	$348,476 15

The total receipts of the Receiving Clerk from January 1, 1898, to January 1, 1899, were as follows:

January	$ 44,400 44	
February	5,941 41	
March	11,798 22	
April	45,006 68	
May	7,816 97	
June	53,626 70	
July	63,360 66	
August	65,154 02	
September	16,882 66	
October	48,439 83	
November	10,190 78	
December	14,546 84	
	$387,165 21	
Cash on hand January 1, 1898	4,172 60	
		$391,337 81

With bank deposits as follows:

January	$ 42,440 37	
February	10,232 57	
March	9,461 19	
April	42,533 12	
May	12,792 29	
June	52,416 88	
July	61,002 54	
August	68,830 79	
September	15,197 70	
October	46,493 44	
November	13,570 61	
December	13,157 21	
	$388,128 71	
Cash on hand January 1, 1899	3,209 10	
		$391,337 81

Cash Statement, Year 1898.

January 1, 1898.		Dr.	
Cash on hand		$ 4,172 60	
American Exchange National Bank—			
Balance General Fund		58,246 57	
Balance Secretary's Fund		1,000 00	
Receipts, 1898		387,165 21	
			$450,584 38
January 1, 1899.		Cr.	
Cash on hand		$ 3,209 10	
American Exchange National Bank—			
Balance General Fund	$20,519 26		
Checks outstanding	734 65		
		19,784 61	
American Exchange National Bank—			
Sinking Fund		75,376 86	
Secretary's Fund		1,000 00	
Hurlbut Fund	$ 2,741 16		
Checks outstanding	3 50		
		2,737 66	
Disbursements		348,476 15	
			$450,584 38

THE AMERICAN EXCHANGE NATIONAL BANK.

DETROIT, January 3, 1899.

H. S. STARKEY, *Secretary Board of Water Commissioners, Detroit, Mich.:*

DEAR SIR—This is to certify that the amount of your General Account balance in this bank at close of business December 31, 1898, was $20,519.26; Sinking Fund was $75,376.86, and Hurlbut Fund $2,741.16.

Yours respectfully,

HAMILTON DEY,
Cashier.

The following table is the report of the assessment made in May and June, to commence July 1, 1898.

ASSESSMENT 1898-99.

Dist.	WARDS.	FAMILIES.			Increase.	Vacant Tenements.	ASSESSMENT.		
		Supplied.	Not Supplied.	Whole Number.			1898-99.	Decrease.	Transf'rd to Meter Rolls.
1	Ninth.......	5,422	14	5,436	72	167	$12,721 00	$4,473 00	$ 71 00
	Fifteenth...	1,778	7	1,785	95	58	5,725 05	776 70	17 00
	Seventeenth	1,855	14	1,869	155	78	5,977 95	574 05	35 00
	Totals ...	9,055	35	9,090	178	303	24,424 00	5,823 75	123 00
2	Eleventh ...	3,819	9	3,828	104	87	10,180 60	2,670 90	66 50
	Thirteenth..	2,880	2	2,882	144	67	8,125 80	1,653 75	66 00
	Totals ...	6,699	11	6,710	248	154	18,306 40	4,324 65	132 50
3	First........	2,803	1	2,804	33	76	13,619 35	2,129 50	77 25
	Seventh	3,408	11	3,419	40	54	8,085 45	2,936 55	78 50
	Totals....	6,211	12	6,223	7	130	21,704 80	5,066 05	155 75
4	Third.......	3,480	14	3,494	135	80	9,284 15	2,365 75	79 50
	Fifth........	4,005	9	4,014	54	91	9,930 25	3,152 70	60 50
	Totals ...	7,485	23	7,508	189	171	19,214 40	5,518 40	140 00
5	Second	2,261	6	2,267	64	107	17,831 55	1,018 95	122 50
	Sixth........	3,838	5	3,843	116	108	12,764 10	2,602 85	57 00
	Totals ...	6,099	11	6,110	180	215	30,595 65	3,621 80	179 50
6	Tenth.......	4,384	12	4,396	87	163	12,505 65	3,443 20	100 00
	Fourteenth.	2,590	19	2,609	65	73	7,142 65	2,011 50	54 00
	Totals ...	6,974	31	7,005	152	226	19,648 30	5,454 70	154 00
7	Fourth......	3,244	5	3,249	19	196	12,663 75	3,274 15	279 75
	Twelfth	3,520	2	3,522	81	131	9,547 95	2,716 45	83 00
	Totals ...	6,764	7	6,771	62	327	22,211 70	5,990 60	362 75
8	Eighth......	3,725	4	3,729	120	118	11,994 80	2,306 45	94 55
	Sixteenth...	3,329	175	3,504	213	71	8,743 45	1,930 15	52 12
	Totals ...	7,054	179	6,233	333	189	20,738 25	4,236 60	146 67
	Aggregate	56,341	309	56,650	1,335	1,725	$176,843 50	$40.036 55	$1394 17

As shown in this table, July 1, 1898, there were 56,650 families in the city of Detroit. Using the same average per family as in previous years, 5.14, the population of the city at that time was 291,181, an increase over July 1, 1897, of 5,862.

The average used was obtained by taking the population as shown by the United States Census of 1860-70-80 and 90, and dividing by the number of families on Assessors' books for those years, as follows:

Years.	Population per census.	No. of families assessed.	Average.
1860	45,619	8,973	5.08
1870	79,757	14,717	5.42
1880	116,340	22,423	5.18
1890	205,876	42,059	4.80

Making the general average 5.14.

The decrease in assessments as compared with 1897-8 was $40,036.55, of which $1,394.17 was by transfer to the meter rolls, leaving a decrease to the benefit of the rate payers of $38,642.38. The decrease in 1897 was $66,494, making a total decrease in 1897 and 1898 of $105,136.38. The rates in Detroit are the lowest, so far as can be ascertained, of any city in the world.

The following table shows the receipts for water rates during the year, arranged by districts, and giving the amount collected upon each annual assessment:

RECEIPTS OF WATER RATES BY DISTRICTS.

YEARS.	1st District Wards 9, 15 and 17.	2d District, Wards 11 and 13.	3d District, Wards 1 and 7.	4th District, Wards 3 and 5.	5th District, Wards 2 and 6.	6th District, Wards 10 and 14.	7th District, Wards 4 and 12.	8th District, Wards 8 and 16.	Meters, Jan. 1, 1898, to Jan. 1, 1899.	Aggregate.
1890-1	....	....	....	....	....	....	$1 25	....	....	$1 25
1892-3	....	$2 25	....	....	....	....	....	....	....	2 25
1893-4	....	1 65	$5 00	....	$1 25	$1 25	2 50	$3 75	....	15 40
1894-5	$6 25	2 50	10 00	$3 75	8 75	12 63	2 50	....	....	46 38
1895-6	15 09	1 25	19 75	31 25	11 50	6 75	13 45	5 25	....	104 29
1896-7	16 20	23 25	70 75	17 25	48 17	65 68	28 75	77 45	....	347 50
1897-8	12,530 33	9,118 67	11,577 93	9,947 36	14,760 89	10,479 81	11,808 99	10,716 53	....	90,940 51
1898-9	12,670 78	9,417 39	11,107 02	9,893 97	13,132 75	9,831 47	11,209 19	10,769 92	$57,253 06	145,285 55
Total..	$25,238 65	$18,566 96	$22,790 45	$19,893 58	$27,963 31	$20,397 59	$23,066 63	$21,572 90	$57,253 06	$236,743 13

Water Works Bonds.

The following table shows the whole history of the bonded indebtedness of the Board, in which it will be seen that the total amount of bonds issued is $1,950,000, of which $917,000 have been redeemed, leaving outstanding $1,033,000. Of this, $100,000 will be due September 1, 1899.

No. of Issue.	Act of	Issued.	Payable.	Amount.	Rate of Interest.	Redeemed.	Outstanding.
1st	1853	Aug. 1, 1853	Aug. 1, 1883	$100,000	7cts.	$100,000	....
"	"	" "	Aug. 1, 1878	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1873	50,000	7 "	50,000	... .
2nd	1855	Aug. 1, 1855	Aug. 1, 1890	100,000	7 "	100,000	....
"	"	June 12, 1855	Aug. 1, 1885	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1880	50,000	7 "	50,000	....
3rd	1857	Aug. 1, 1858	Aug. 1, 1893	150,000	7 "	150,000	....
"	"	Aug. 1, 1867	Aug. 1, 1887	100,000	7 "	100,000	....
4th	1869	Feb. 1, 1870	Feb. 1, 1900	100,000	7 "	....	100,000
5th	"	Aug. 1, 1872	Aug. 1, 1902	50,000	7 "	....	50,000
6th	"	Aug. 1, 1873	Aug. 1, 1903	50,000	7 "	....	50,000
"	1873	Feb. 1, 1874	Feb. 1, 1904	50,000	7 "	9,000	41,000
7th	1869	Aug. 1, 1874	Aug. 1, 1904	50,000	7 "	6,000	44,000
"	1873	" "	" "	200,000	7 "	....	200,000
"	"	June 1, 1875	June 1, 1905	150,000	7 "	1,000	149,000
"	"	June 1, 1876	June 1, 1906	200,000	6 "	1,000	199,000
"	"	Sept. 1, 1880	Sept. 1, 1899	100,000	4 "	....	100,000
"	"	April 1, 1881	April 1, 1897	100,000	4 "	100,000	....
"	"	Dec. 1, 1881	Dec. 1, 1896	50,000	4 "	50,000	....
"	"	Jan. 10, 1895	Jan. 10, 1925	100,000	4 "	....	100,000
				$1,950,000		$917,000	$1,033,000

The amount expended for the Pumping Works to January 1, 1899, is as follows:

ITEMS.	Previously Expended.	1898.	Total.
Land	$38,331 44	....	$38,331 44
Force Mains	624,058 03	....	624,058 03
Inlet Pipe	90,811 84	$606 00	91,417 84
Dock, Basin and Canal	148,291 60	....	148,291 60
Conduits and Wells	81,461 70	....	81,461 70
Engine, Boiler and Coal Houses	216,942 26	589 45	217,531 71
Stand Pipe and Tower	31,574 16	....	31,574 16
Pump Wells	54,221 56	....	54,221 56
Engines	356,860 62	2,478 25	359,338 87
Boilers	76,769 66	....	76,769 66
Engineer's House	8,139 75	....	8,139 75
Sewers	3,666 25	3,000 00	6,666 25
Electric Light Plant	718 49	....	718 49
Grounds, Fences and Gateway	138,741 09	6,273 38	145,014 47
Inspection	2,989 86	65 56	3,055 42
Miscellaneous	14,326 53	....	14,326 53
Library, Greenhouse and Belvedere	....	8,294 46	8,294 46
Totals	$1,887,904 84	$21,307 10	$1,909,211 94

Estimated Valuation of the Works.

Real Estate	$ 441,871 75
Buildings, docks, basins, conduits, engines, etc., at pumping station	1,685,059 13
Water pipe in use	3,712,353 82
Meters in use	102,804 27
Office furniture and fixtures	16,000 00
Tools and materials on hand:	
In office of Supt. of Construction	94 50
In office of Civil Engineer	16,851 72
In Inspection Department	187 70
In Meter Department	1,937 02
In Pumping Works Department	22,829 27
In Hurlbut Fund Department	1,295 25
At storage grounds	29,679 86
Total	$6,030,963 29

All of which is respectfully submitted.

H. S. STARKEY,
Secretary.

REPORT OF THE GENERAL MANAGER.

Detroit, January 3, 1899.

To the Board of Water Commissioners of the City of Detroit:

Gentlemen—I respectfully submit a report of the general operations of the Works for the year ending December 31, 1898.

Pumping Works.

It was found necessary to make extensive repairs to the foundation of Engine No. 2. This work was done under the direction of Chief Engineer Gould, and is now in first-class condition.

Three of the boilers have been equipped with the Murphy stocker, two having been placed during the year. The fourth of the battery is still equipped with the Hawley Down Draft furnace.

The new Greenhouse and the Belvedere at the head of the canal are nearing completion, and will add much to the beauty of the grounds. The Greenhouse was very much needed and will aid largely in capacity for propagation purposes and the care of plants necessary for use the coming season.

The new Library Building, the erection of which began in the Fall, will soon be completed, and will be a fitting home for the valuable scientific library presented to the citizens of Detroit through the liberality of the late Chauncey Hurlbut.

The grounds during the year have been kept in good condition and many improvements have been made, particularly the removal of the water gate stems in front of Engine House and the regrading of Central Island and the grounds west of the canal.

A system of sewerage was instituted whereby the grounds will be drained into the river west of the canal. There still remains about 350 feet of extension for outlet to be completed, which must be deferred until the removal of the steamer Milton D. Ward, which lies directly in the place necessary to be used.

In August the city was directed, by order of the courts, to remove this steamer, but did not comply with the decree. Proceedings were commenced, in the nature of contempt proceedings, for failure to comply, and a speedy settlement is expected, when the work can be completed.

The following table shows the gallons of water pumped each year from 1887 and the cost per person:

YEARS.	Supplied Population.	Gallons Pumped.	Cost of Pumping.	Cost per Person.
1887	177,258	13,168,859,808	$57,352 00	32⅓ cts.
1888	189,475	14,380,166,670	60,284 11	31⅘ cts.
1889	201,272	12,875,334,453	61,560 48	30½ cts
1890	213,140	12,120,944,532	54,433 49	25½ cts.
1891	225,815	12,057,261,236	53,012 77	23 4/9 cts.
1892	238,496	12,276,612,482	53,287 89	22⅓ cts.
1893	256,059	13,877,977,208	46,546 01	18⅐ cts.
1894	256,547	13,649,779,605	48,146 11	18¾ cts.
1895	264,329	14,698,451,954	51,772 07	19⅗ cts.
1896	277,256	13,254,369,371	53,234 42	19⅕ cts.
1897	282,417	12,928,821,326	38,123 99	13½ cts.
1898	289,593	14,278,682,058	38,567 52	13⅓ cts.

Purity of the Water.

The purity of the water supply is of so much importance to the public that the following extract from the last report of the Board of Health is submitted:

OUR WATER SUPPLY.

Samples of our drinking water have been subjected each month to chemical and bacteriological examinations, the results of which show little variation in the quality of our supply from that of last year. The most noticeable change from month to month was found, as in former years, during or shortly after the spring freshets, at a time when there was much recently melted ice and snow in our lakes and rivers, and when they were receiving large quantities of drainage water from the surrounding country. At that time the water was very roily, and there was a marked increase in the amount of vegetable and earthy matter and in the number of bacteria present. I was unable, however, at this period or at any time during the year, to discover any indication of disease-producing germs. The bacteria present had no effect whatever upon animals, and the bacillus typhi abdominalis (bacillus of typhoid fever) was searched for repeatedly, but not found. We are indeed to be congratulated that infection from the typhoid fever epidemic raging at St. Clair and other towns above us, during the late winter and early spring, did not reach our intake pipe. That it did not is evidenced by the fact that there were even fewer deaths from typhoid fever during the months following that epidemic than at any other part of the year. Our death rate from typhoid fever for the year was less than 1.4 per 10,000 population, which is very low compared with that of other American cities.

Appended is a table giving results of the monthly examinations of our water:

RESULTS OF CHEMICAL ANALYSES ARE IN PARTS PER MILLION.

	July, 1897.	August.	September.	October.	November.	December.	January, 1898.	February.	March.	April.	May.	June.
Appearance	* N. C.	N. C.	N. C.	N. C.	S. T.	T.	T.	T.	V. T.	T.	S. T.	S. T.
Reaction	† N.	N.	N.	N.	N.	N.	N.	N.	N.	N.	N.	N.
Total Solids	107.6	111.2	111.6	117.4	120.4	134.4	128.8	128.4	138.8	130.4	122.4	115.0
Volatile and Organic Matter	34.0	37.2	39.8	40.4	39.6	37.6	34.8	36.0	37.8	35.0	37.2	39.8
Non-Volatile and Mineral Matter	73.6	74.0	71.8	77.0	80.8	96.8	94.0	92.4	101.0	95.4	85.2	75.2
Free Ammonia	.038	.042	.030	.038	.042	.050	.046	.090	.036	.040	.048	.022
Albuminoid Ammonia	.086	.090	.098	.086	.088	.096	.086	.126	.104	.090	.074	.130
Nitrogen as Nitrates	.115	.131	.066	.099	.115	.148	.181	.115	.346	.181	.148	.066
Nitrogen as Nitrites	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Chlorine	2.50	2.50	3.00	2.85	2.90	2.75	2.90	3.23	2.99	2.89	2.74	2.65
Oxygen absorbed in fifteen minutes	44	.38	.54	.66	.62	1.02	.82	.94	2.36	1.00	.64	.66
Oxygen absorbed in four hours	.92	.80	1.06	1.10	1.02	1.48	1.36	1.82	3.16	1.80	1.04	.90
Bacteria, per cubic centimeter	280	90	180	88	280	34	320	720	1,440	340	68	103
Bacteria, per cubic centimeter	120	300	130	120	190	42	210	1,200	1,840	272	49	120
Bacteria, per cubic centimeter	210	160	40	286	478	86	126	820	6,400	208	105	64
Bacteria, per cubic centimeter	......	......	36	......	......	......	......	......	5,760	......	208	195
Bacteria, per cubic centimeter	......	......	......	......	......	......	......	......	4,920	......	......	......

* N. C.—Nearly clear. S. T.—Slightly turbid. T.—Turbid. V. T.—Very turbid.

† N.—Neutral.

Economy of Waste.

HISTORICAL.

YEARS.	FAMILIES SUPPLIED.	WATER PUMPED.	
		TOTAL QUANTITY.	PER FAMILY
1852	......	235,840,275	.....
1853	4,283	303,531,743	70,86
1854	4,619	376,265,126	81,46
1855	5,282	542,807,364	102,76
1856	5,706	692,124,305	121,29
1857	6,189	697,190,523	112,65
1858	6,474	718,091,207	110,91
1859	6,794	782,112,587	115,11
1860	6,750	870,036,451	125,18
1861	7,128	895,129,423	125,57
1862	7,275	994,945,329	136,76
1863	7,699	1,035,798,043	134,53
1864	7,993	1,019,390,256	127,41
1865	8,351	1,040,514,887	125,67
1866	9,089	1,196,317,922	131,62
1867	10,242	1,425,535,230	139,18
1868	11,544	1,666,545,125	144,36
1869	12,774	1,946,810,325	152,40
1870	13,722	1,866,060,068	136,00
1871	14,896	2,300,150,605	154,41
1872	16,035	2,782,292,578	173,51
1873	17,019	3,198,393,948	187,93
1874	18,853	3,289,872,635	174,51
1875	19,606	4,207,454,260	214,60
1876	20,102	4,065,134,470	200,22
1877	20,345	4,213,239,790	207,09
1878	20,603	4,345,743,330	210,92
1879	21,341	5,129,599,110	240,34
1880	22,465	5,552,965,310	247,18
1881	23,749	6,543,127,968	279,72
1882	25,442	6,284,000,742	243,06
1883	27,415	7,379,327,788	269,17
1884	29,424	8,510,614,140	289,26
1885	30,533	9,970,829,580	326,88
1886	31,946	10,576,571,254	331,07
1887	34,486	13,168,859,808	381,86
1888	36,863	**14.380,166.670**	**390,09**
1889	39,158	12,875,334,453	328,88
1890	41,467	12,120,944,532	292,30
1891	43,933	12,057,261,236	274,47
1892	46,400	12,276,612,482	264,58
1893	49,817	13,877,977,208	278,57
1894	49,912	13,649,779,605	273,47
1895	51,426	14,698,451,954	285,81
1896	53,941	13,254,369,371	245,71
1897	54,945	12,928,821,326	235,30
1898	56,341	14,278,682,058	253,43

Water Rates.

In 1891, and in almost every succeeding year thereafter, there have been certain reductions in the rates, which are narrated below and which have had the following effects:

YEARS.	No. of Families Supplied.	Rates Received.	Average per Family.
1891	43,933	$389,079 97	$8 85
1892	46,400	402,534 98	8 67
1893	49,817	420,490 83	8 44
1894	49,912	418,728 76	8 39
1895	51,426	428,772 41	8 34
1896	53,941	406,147 82	7 52
1897	54,945	335,997 28	6 09
1898	56,341	236,743 13	4 20

The reductions in the schedule of rates since 1890 have been as follows:

September 1, 1890, meter rates were reduced to 3⅓ cents per 1,000 gallons for quantities exceeding 3,000 cubic feet each month. Under 3,000 cubic feet, to 6⅔ cents per 1,000 gallons.

July 1, 1891, the charge for the use of hose for lawn and street sprinkling was abated, the annual amount previously received therefrom being estimated at about $20,000. Hose tax was restored July 1, 1897.

July 1, 1894, the rates on fixtures were largely reduced.

April 1, 1896, the meter rate was reduced to 2 2-9 cents per 1,000 gallons for all over 3,000 cubic feet each month.

July 1, 1896, the rate of $5 upon families for household purposes was reduced to $4.

July 1, 1897, a 25 per cent reduction was made in the entire schedule of rates, meter and assessed.

January 1, 1898, an additional 25 per cent. reduction was made.

The average rate per family from 1887 to 1890 was $9.36, and, in order to show the total reductions made in the water rates since 1890, the following table is introduced:

YEARS.	No. of Families Supplied.	Rates Received.	Rates would have received at the average of $9.36 per family.
1891	43,933	$389,079	$411,212
1892	46,400	402,534	434,304
1893	49,817	420,490	466,287
1894	49,912	418,728	467,176
1895	52,426	428,772	490,707
1896	53,941	406,147	504,887
1897	54,945	335,997	514,285
1898	56,341	236,743	527,352
Totals		$3,038,490	$3,816,210
Total of reductions			$777,720

COMPARATIVE STATEMENT.

	1887.	1888.	1896.	1897.	1898.
Daily average consumption in gallons.......	36,079,068	39,397,716	36,313,340	35,421,430	39,092,252
Daily average consumption per capita.......	195	204	130	124½	185
Total annual consumption....................	13,168,859,808	14,888,166,670	13,254,369,371	12,928,821,326	14,278,682,058
Total consumption through meters..........	65,182,000	91,750,000	2,263,413,500	2,427,447,000	2,807.839
Revenue from unmetered water.............	$316,316.30	$335.140.10	$321,742.23	$256,164.17	$286,743 13
Revenue from metered water...............	$6,518.20	$9,175.00	$84,405.59	$79,833 11	$57,253 06
Per 1,000 gallons metered water.............	.10	.10	.037+	.033	.02
Per 1,000 gallons unmetered water...........	.024	.023	.029+	.024+	.026
Number of families supplied.................	34,486	36,863	53,941	54,945	56,341
Number of service connections...	32,938	36,609	50,599	52,219	53,720
Miles of pipe.................................	322	325	518	526	553
Number of meters...........................	About 40	48	4,584	5,392	5,470
*Estimated population.......................	184,829	194,996	279,107	284,319	291,181

* Population estimated by multiplying families in city by 5.14.

Pipeage System.

You are respectfully referred to the report of the Superintendent of Construction for a detailed account of the work done in his department during the year.

The total mileage of the distribution system January 1, 1899, is $553\frac{931}{5280}$ miles, of which $28\frac{3131}{5280}$ miles were laid during the year; $14\frac{2083}{5280}$ miles were laid in the city, $13\frac{2377}{5280}$ miles were laid in the village of Delray and 3914 feet laid in the village of Grosse Pointe, making a total laid outside the city of $14\frac{1043}{5280}$ miles, the entire cost of which was paid by said villages; $1\frac{4338}{5280}$ miles of pipe were replaced by pipe of larger size.

A contract was entered into in the spring with the village of Delray to pipe the village and connect and supply water from the Detroit system. The entire cost of the work to the present time, $48,560.66, has been paid by the village. The system will soon be completed and meters placed, when the water furnished will be paid for by meter measurement.

All of which is respectfully submitted.

MARSHALL H. GODFREY,
General Manager.

REPORT OF THE CIVIL ENGINEER.

Detroit, Mich., January 3, 1899.

To the Honorable Board of Water Commissioners of the City of Detroit:

Gentlemen—I have the honor to submit the following report, covering the operations of your Engineering Department for the year 1898:

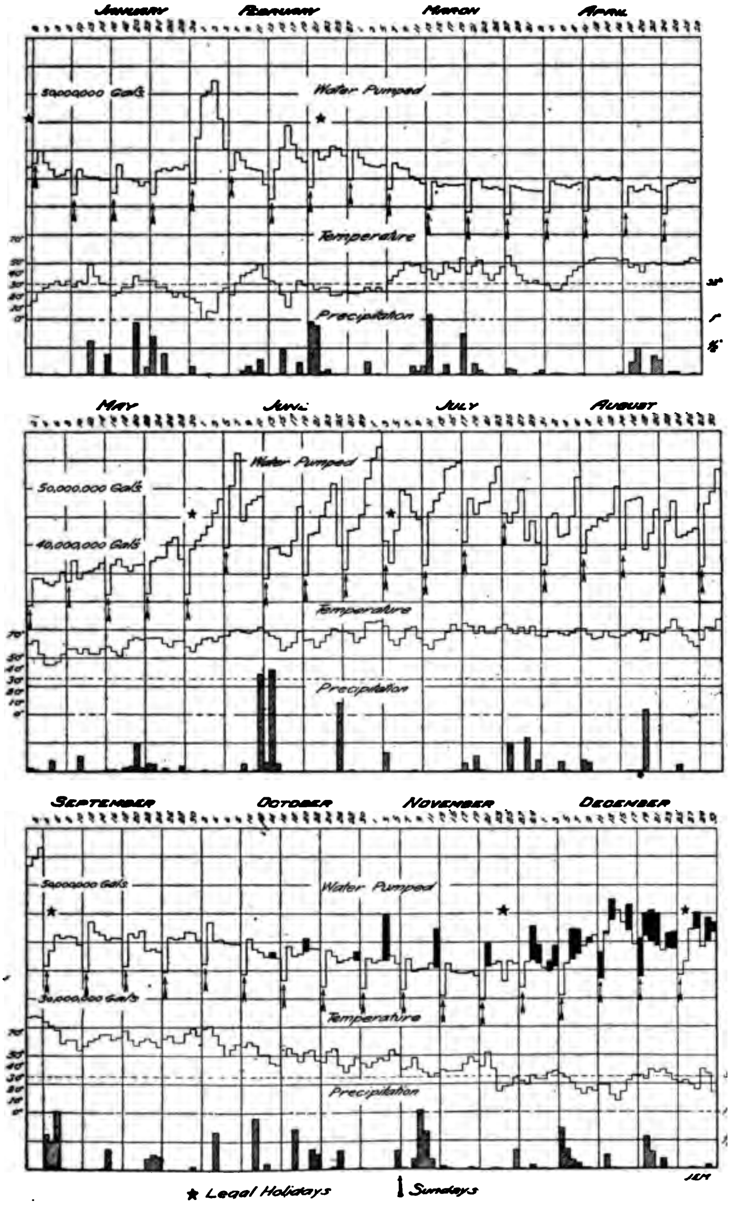
Distribution System.

The daily consumption of water for the year has averaged 135.1 gallons per consumer, an increase of nearly 10 gallons over 1897, and about five gallons in excess of the consumption in 1896. The consumption of water from year to year is subject to variation due to many causes, and is very largely dependent upon conditions of temperature and rainfall. The quantity of water used for flushing purposes during the past season is considerably larger than ever before; the leakage is somewhat greater on account of slightly increased pressures; nearly a thousand meters have been practically discontinued, causing some increase in waste. Add to these the fact that business is resuming its normal activity, and the increased per capita consumption is fully accounted for.

Plate 1, page 35, shows the relation existing between the total water pumped, total precipitation and mean temperature for each day of the year. The cold weather the first of February is seen to have caused an increased consumption of about fifteen million gallons per day, while the

Plate I

DAILY WATER
1898 PRECIPITATION AND TEMPERATURE



falling temperature, combined with rainfall which occurred on Sunday, September 4, caused a decrease of nearly twenty million gallons per day. Throughout the entire year the interesting phenomena incident to varying weather conditions obtain, and need not be further discussed except to say that the effects in June, July and August are in a few instances obscured by the use of water in considerable quantities for experimental purposes.

Plate 2 shows all mains in the distribution system eight inches in diameter and over, in connection with the ten-foot contour lines. The only extension of note is the line of sixteen and twelve-inch pipe to supply Delray. To obtain the average pressure at which water is delivered, twenty-five pressure gauges are placed in fire engine houses at locations indicated on Plate 2. These gauges are read once an hour by Fire Department employes. The average pressure for 1898 is 23.51 pounds; for 1897 it was 22.98, which shows an increase of about half a pound. The pressure at the pumps was about a pound higher for 1898 than for 1897, the extra half pound being required to overcome the additional friction on account of increased consumption.

The work done by the engines aggregates 13,462,549,931,850 foot pounds, of which 38.22 per cent was used to lift the water to the required elevation, 13 per cent to overcome the friction of water in pipes and 48.78 per cent to deliver the water at the required pressure and volume through service pipes, house plumbing, etc.

Flushing Mains.

At certain seasons of the year the Detroit River is roiled by the action of winter storms and floating ice in the shallow lake above us. At such times large quantities of mud are introduced into the distribution system. As a result deposits of silt are formed in all pipes where the flow of water is such

Plate 2

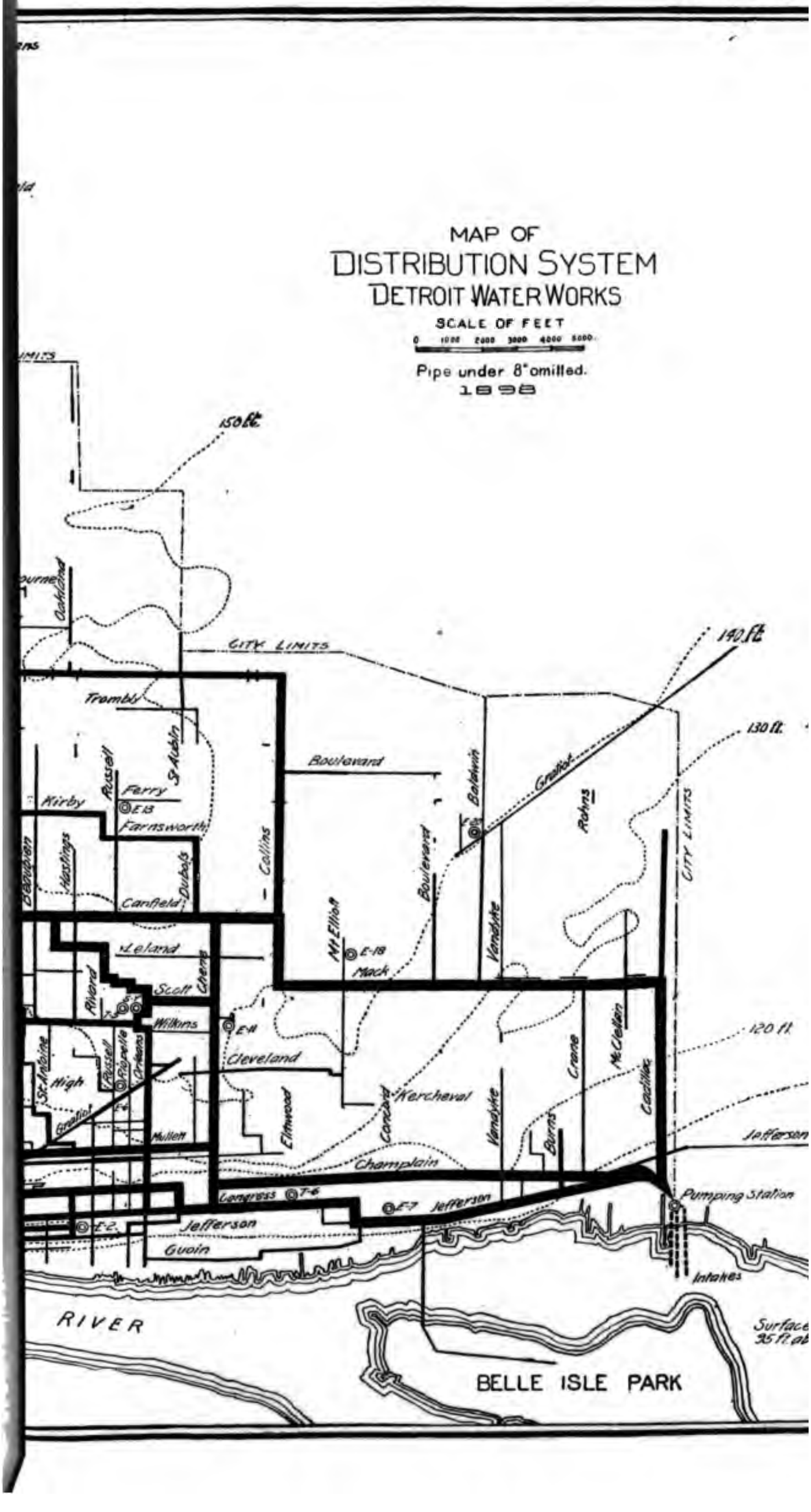
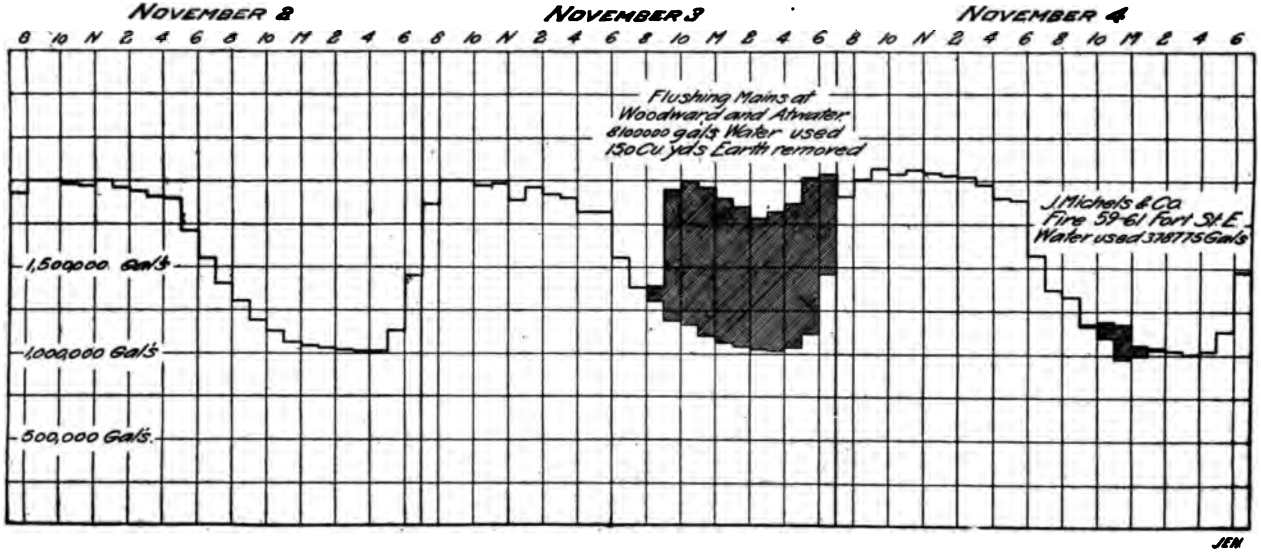

MAP OF
DISTRIBUTION SYSTEM
DETROIT WATER WORKS
SCALE OF FEET
0 1000 2000 3000 4000 5000
Pipe under 8" omitted.
1898
150 ft.
140 ft.
130 ft.
120 ft.
CITY LIMITS
Trombly
St. Aubin
Russell
Ferry
E13
Kirby
Farnsworth
Collins
Boulevard
Baldwin
Gratiot
Rohns
Beaubien
Hastings
Dubois
Canfield
Leland
Chene
Mt. Elliott
E-18
Mack
Riviard
Scott
Wilkins
E-11
Cleveland
St. Antoine
High
Russell
Orleans
Gratiot
Mullett
Elmwood
Concord
Kercheval
Vandyke
Burns
Crane
McClellan
Cadillac
Champlain
Jefferson
Congress
T-6
E-7
E-2
Jefferson
Guoin
Pumping Station
Intakes
RIVER
BELLE ISLE PARK
Surface
95 ft. ab

Plate 3

1898 HOURLY CONSUMPTION OF WATER



as to admit of sedimentation. In September several large pipes were found on examination to be nearly or quite half full of this deposit and complaints of bad water came in every time the ordinary flow of water was distributed by closing gates or by other means. A system of blow-offs was designed and put into operation at a cost of about $2,000, by means of which all large mains can be effectively flushed and the contents discharged into large sewers. We thus not only clean our own pipes, but greatly improve the condition of the sewers. The quantity of water used for this purpose is shown in solid black on Plate 1, and was very large, amounting in some instances to nearly a million gallons per hour, or the full capacity of one pumping engine. It was found necessary to do the work at night in order to maintain pressures and not overtax the engines. A night crew was organized and twenty-five blow-offs made. We used about one hundred million gallons of water in the work and removed over two thousand cubic yards of solid material.

It was at first feared that the foul condition of the pipes might prove a serious source of contamination, but upon examination by the Health Board the deposit was found to contain nothing of a particularly injurious character, being composed of 88.9 per cent mineral and 11.1 per cent volatile matter, all of the same nature as the solid matter found in suspension in river water when roily. Since completing this work, only one complaint of bad water has been received—a sufficient testimony of the good results attained.

The shaded portion of Plate 3 shows graphically the quantity of water used hourly in a blow-off made at Woodward and Atwater, and compares it with the water used at an ordinary fire which occurred on the night following.

Plate 4 is especially interesting because it shows the probable effect of future Delray consumption on the pressures in our present system. The upper line shows the normal pressure at the points indicated; the lower line shows the pressure at the same points with an equal pressure main-

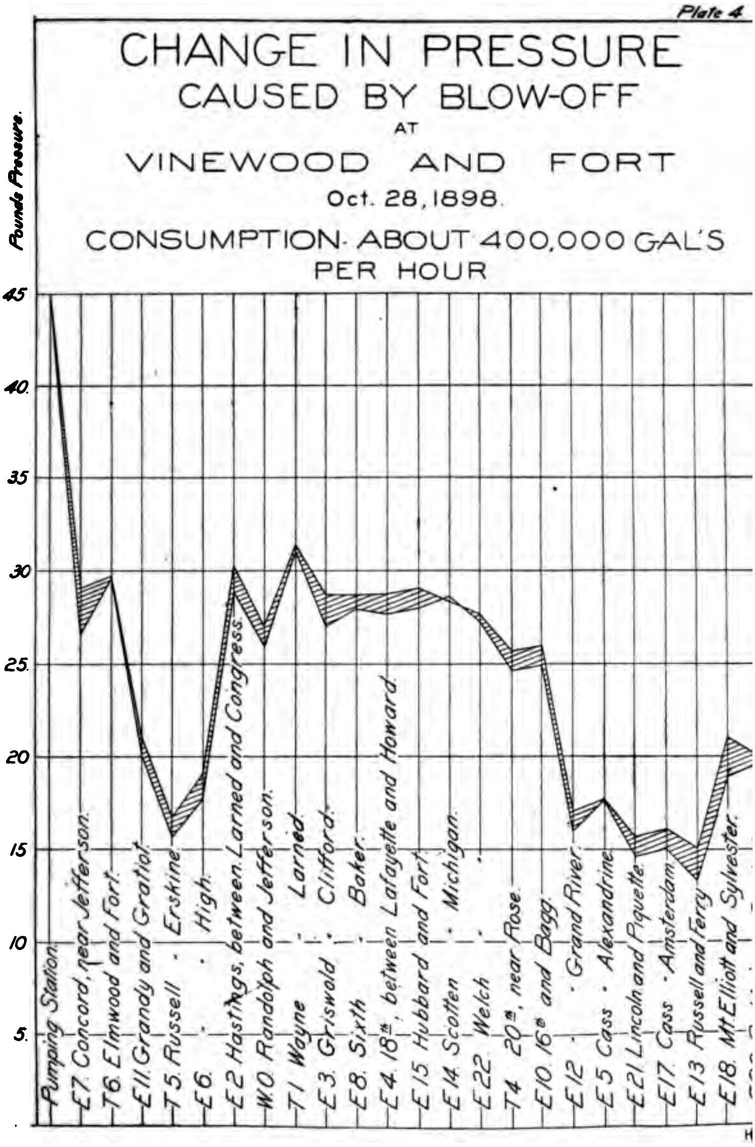


Plate 4
CHANGE IN PRESSURE
CAUSED BY BLOW-OFF
AT
VINEWOOD AND FORT
Oct. 28, 1898.
CONSUMPTION ABOUT 400,000 GAL'S
PER HOUR
Pounds Pressure.
45
40.
35
30
25.
20
15
10
5.
Pumping Station.
E7. Concord, near Jefferson.
T6. Elmwood and Fort.
E11. Grandy and Gratiot.
T5. Russell · Erskine.
E6. · High.
E2 Hastings, between Larned and Congress.
W.O. Randolph and Jefferson.
T1 Wayne · Larned.
E3. Griswold · Clifford.
E8. Sixth · Baker.
E4. 18th, between Lafayette and Howard.
E15 Hubbard and Fort.
E14 Scotten · Michigan.
E22 Welch · ·
T4 20th, near Rose.
E10. 16th and Bagg.
E12 · Grand River.
E5 Cass · Alexandrine.
E21 Lincoln and Piquette.
E17. Cass · Amsterdam.
E13 Russell and Ferry.
E18. Mt Elliott and Sylvester.

tained at the pumps and a blow-off open at Vinewood and Fort which discharged about four hundred thousand gallons per hour. The shaded portion represents the resultant loss of pressure, and, as will be noted, is the largest in the northern portion of the city.

Drafting Room.

The present force, while somewhat smaller than it has been in recent years, is composed of experienced men, well organized, and will be able to perform the routine work of the department without enlargement. Our drawings are growing more accurate and more valuable from year to year. Eight hundred and six tracings have been drawn or corrected during the season and an equal number of blue prints furnished to the Construction Department and others. The changes in the arrangement of the Drafting Room have been made as authorized and add materially to the comfort and convenience of the department.

Experimental Work.

During the past year some time has been devoted to experimental work. A discussion of the details would necessarily be long and technical, and will be here omitted. The results as a whole have been satisfactory, and can be summarized as follows:

The pitot tube is an instrument for measuring the flow of water and its principles have long been known to hydraulic engineers, but its use has been restricted, owing to mechanical imperfections. We have succeeded in so perfecting it that the flow of water at any point in a pipe can be ascertained with reasonable accuracy by simply inserting the tube through an ordinary one-inch corporation cock. Its use will be of much service in designing future extensions. Our investigations will also lead to the saving of considerable money in the cost of special castings.

Recommendations.

In some localities the small pipes still contain deposits of sediment. In order to facilitate its removal, I respectfully recommend that blow-offs be set where needed for this work.

The subject of valves has already been treated of in a special report.

Plans and estimates for the construction necessary to "supply the northern portion of the city with a quantity of water at the desired pressure sufficient to meet the needs of the present and future" will be presented as soon as completed.

All of which is respectfully submitted.

C. W. HUBBELL,
Civil Engineer.

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

Detroit, January 10, 1899.

To the Board of Water Commissioners:

Gentlemen—In compliance with the rules and regulations of your honorable body, I herewith report the work done in the Meter, Inspection and Service Cocks Department during the year 1898.

NUMBER OF METERS PLACED DURING THE YEAR, AND TOTAL NUMBER IN SERVICE JANUARY 1, 1899.

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
In service Jan. 1, 1898.........	3,120	1,035	746	185	183	75	43	6	5,393
Placed during the year 1898...	1	9	30	29	5	3	......	......	77
Total number in service Jan. 1, 1899....................	3,121	1,044	776	214	188	78	43	6	5,470

IN SERVICE JANUARY, 1, 1899.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson......................	3,074	1,022	688	201	153	61	28	6	5,283
Crown........................	28	14	42	10	11	8	4	......	117
Hersey	1	4	32	2	11	2	8	......	60
Worthington..................	9	4	14	......	12	7	1	......	47
Union Rotary	8	......	......	1	1	......	1	......	11
Buffalo...........	1	......	......	......	......	......	......	......	1
Venturi......................	......	......	......	......	......	......	1	......	1
Aggregate..............	3,121	1,044	776	214	188	78	43	6	5,470

Indicators attached to hydraulic elevators.. 23

METERS IN STOCK.

KIND.	SIZES.					
	⅝ in.	1 in.	1½ in.	[illegible]	[illegible]	[illegible]
Thomson	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Crown		[illegible]	[illegible]		[illegible]	
Hersey		[illegible]		[illegible]		
Aggregate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Valuation of meters in stock January 1, [illegible]		$[illegible]
Valuation of material on hand January 1, [illegible]		[illegible]
Valuation of tools January 1, [illegible]		[illegible]
Valuation of horses, wagons, etc., January 1, [illegible]		[illegible]
Valuation of furniture and fixtures, January 1, [illegible]		[illegible]
Total valuation of stock on hand January 1, [illegible]		$[illegible]
Valuation of meters in service January 1, [illegible]	$[illegible]	
Deduct [illegible] per cent for depreciation in value	[illegible]	
		$[illegible]
Add amount expended during the year for meters placed		[illegible]
Total valuation of meters in service January 1, [illegible]		$[illegible]
Cost of material used in repairing meters, [illegible]	$[illegible]	
Cost of labor repairing meters, [illegible]	[illegible]	
		$[illegible]
Less amount received for repairing meters		[illegible]
Total cost of repairs		$[illegible]

SUMMARY OF TOTAL AMOUNT EXPENDED IN THE METER DEPARTMENT FOR THE YEARS 1889 TO 1898, INCLUSIVE.

	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	TOTAL.
Meters......	$11,175 00	$18,700 00	$6,501 55	$12,371 82	$6,987 43	$8,824 08	$9,235 11	$10,435 76	$7,955 97	$1,790 75	$93,977 47
Supt. and labor........	1,734 10	8,510 57	4,841 49	8,269 17	8,980 48	6,672 20	6,647 89	6,340 08	6,078 78	4,531 11	62,605 87
Material, tools, etc........	637 26	2,982 14	872 99	2,132 93	1,650 33	1,833 01	1,384 85	1,035 15	927 90	568 99	14,025 55
Freight, hauling, etc....	98 05	408 97	197 11	244 08	165 12	201 18	71 40	91 11	67 90	13 16	1,558 08
Horses, wagon, etc.........	....	....	....	547 24	184 50	383 07	248 60	238 51	330 80	187 50	2,120 22
Aggregate..	$13,644 41	$30,601 68	$12,413 14	$23,565 24	$17,967 86	$17,913 54	$17,587 85	$18,140 61	$15,361 35	$7,091 51	$174,287 19

Work in the Meter Department during the past year has been limited almost entirely to the care of meters that were in service previous to that time. Only 77 meters were placed during the year, making the total number now in service 5,470, from which should be deducted 1,045, that being the number transferred to the assessment roll, and from which no meter rates are received. This leaves only 4,325 meters that are in actual service.

The meters still remain on the premises of those transferred to the assessment roll, and are read each quarter in connection with the other meters.

In some cases, with those who have made the change, the meter shows that the waste of water has been reckless. Where they consumed not to exceed eleven or twelve thousand gallons in three months when paying meter rates, after changing to the assessment roll their consumption has been from one hundred to two hundred and ninety thousand gallons for the same length of time. The most aggravated cases have been placed back on the meter roll, where meter rates will be charged until the consumption is reduced to where it legitimately belongs. No doubt, were the meters removed from all of those who have made the transfer, many more would be wasting in the same proportion. The meters remaining on the premises have a restraining influence and in a great measure prevents unnecessary waste.

When we have occasion to use small meters, they are removed from the before-mentioned premises, and in this way we will be able to supply the demand for such meters for a long time, making it necessary to purchase only the larger sizes for use on large consumers.

The consumption at Highland Park village, as indicated by the Venturi meter, for the year 1898, was 14,997,000 gallons, and as they pay a flat rate of 3 cents per 1,000 gallons, makes the receipts from that source $449.91.

As there were only about forty connections in service during the year, and nearly all of them domestic, the consumption seems to have been about 200 gallons daily per capita. During the month of July we made several efforts to locate the waste that was apparently going on, but were unable to do so.

In the month of December the consumption was 610,500 gallons, being about 100 gallons daily per capita. There is evidently a waste somewhere, as the village has no system of sewers as yet, and it hardly seems possible for them to consume that quantity of water legitimately; but as they pay for all that enters their system it may not be quite proper for us to question the amount of their consumption.

Inspection.

The Inspection Department as now constituted consists of seventeen inspectors, one for each ward. Their duties require them to perform all of the outside work in their respective wards, which includes the inspection of all plumbing, locating stop boxes, examining for leaks, reading meters, delivering meter bills and also water bills to all estimated consumers, who do not pay the first month in the quarter (this of itself means the delivering of seventy-five thousand notices during the year), shutting off for non-payment, vacancies, etc., turning on water for all purposes and getting the necessary information of all kinds for making a new assessment each year.

Their duties are quite formidable and will require the utmost diligence in order to meet the demands made upon them. They are now busy with their delinquent lists, which will be completed in a few days, when they will commence getting the facts and data for the coming assessment. In fact, some of them are already at this work.

The following table will show the greater portion of th work done in this department during the year 1898:

New connections	1,70
Extensions	62
Buildings inspected	3,13
Fixtures inspected	4,16
Let on new connections	2,14
Let on vacancies	2,78
Building tax notice	69
Delinquents notified	41,34
Shut off for non-payment	66
Shut off for vacancy	2,60
Inquiries for collectors	4,85
Meters read	15,87
Meter bills delivered	13,00
Examinations for leaks	18,34
Leaks reported	1,29
Total	113,22

Service Connections.

Fifteen hundred and forty-one (1,541) service connections were made during the past year; 1,014 were ⅝-inch 474 1-inch, 30 2-inch, 11 3-inch, 9 4-inch and 3 6-inch Thirty-seven ⅝-inch and 3 1-inch connections were discontinued, making the total number of service connections i the city on the first day of January, 1899, 53,720.

There were also inserted for the village of Highlan Park 8 ⅝-inch and 3 1-inch connections, and for Delray 19 ⅝-inch, 16 1-inch, 1 2-inch, 1 3-inch and 2 6-inch connections. The total number of service connections now i Highland Park is 48 and in Delray 268.

One hundred and sixty-six (166) ⅝-inch and 80 1-inc of the old drive cocks have been replaced with the scre cocks. Wherever we have one of the drive cocks expose it is replaced with a screw cock, as with the increased press ure there is great danger of the old ones blowing out whenever they are uncovered. The cost of making the change being very small, it was thought advisable by our former engineer (Mr. Williams) to make said change on all occasions where we found them exposed for any purpose whatever.

Receipts for service cocks during the year	$4,882 35
Receipts for Plumbers' licenses	648 80
Total receipts Service Cocks Department	$5,531 15

TABLE showing the number of taps made, and the different sizes, in each ward during the year 1898.

INSERTED.	WARDS.																	Total.
SIZES.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
⅝-inch	83	9	57	14	48	45	17	41	46	37	42	79	65	51	62	135	183	1,014
1-inch	63	76	21	58	10	30	6	11	12	28	7	15	16	19	29	9	64	474
2-inch	3	5	1	3	1	1	1	1	1	4	1	2	1	1	1	2	1	30
3-inch	1	2	1	1	...	...	1	...	...	1	...	...	1	2	...	...	1	11
4-inch	2	2	...	...	...	...	...	...	1	1	1	1	...	...	1	...	...	9
6-inch	2	..	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	3
Aggregate	154	94	80	76	59	77	25	53	60	71	51	97	83	73	93	146	249	1,541
DISCONTINUED.																		
⅝-inch	7	9	6	...	2	2	2	2	...	2	...	...	...	4	...	1	...	37
1-inch	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	3
Aggregate	9	9	6	...	2	2	2	2	...	2	...	...	...	4	...	2	...	40

	IN 1898.					PREVIOUS TO 1898.					
	⅝-inch.	1-inch.	2-inch.	3-inch.	6-inch.	⅝-inch.	1-inch.	2 inch.	3 inch.	4-inch.	
Delray	194	16	1	1	2	36	14	...	2	2	268
Highland Park	8	3	...	...	...	11	25	...	1	...	48
Aggregate	202	19	1	1	2	47	39	...	3	2	316

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

Detroit, January 10, 1899.

To the Board of Water Commissioners:

Gentlemen—In compliance with the rules and regulations of your honorable body, I herewith report the work done in the Meter, Inspection and Service Cocks Department during the year 1898.

NUMBER OF METERS PLACED DURING THE YEAR, AND TOTAL NUMBER IN SERVICE JANUARY 1, 1899.

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
In service Jan. 1, 1898	3,120	1,035	746	185	183	75	43	6	5,393
Placed during the year 1898	1	9	30	29	5	3	......	......	77
Total number in service Jan. 1, 1899	3,121	1,044	776	214	188	78	43	6	5,470

IN SERVICE JANUARY, 1, 1899.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson	3,074	1,022	688	201	153	61	28	6	5,233
Crown	28	14	42	10	11	8	4	......	117
Hersey	1	4	32	2	11	2	8	......	60
Worthington	9	4	14	......	12	7	1	......	47
Union Rotary	8	......	......	1	1	......	1	......	11
Buffalo	1	......	......	......	......	......	......	......	1
Venturi	......	......	......	......	......	......	1	......	1
Aggregate	3,121	1,044	776	214	188	78	43	6	5,470

Indicators attached to hydraulic elevators	23

METERS IN STOCK.

KIND.	SIZES.						
	⅝ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Tot
Thomson	3	1	1	2	2	1	1
Crown	......	1	1	......	1	......	
Hersey	......	8	......	1	......	......	
Aggregate	3	10	2	3	3	1	

Valuation of meters in stock January 1, 1899		$658 0
Valuation of material on hand January 1, 1899		431 6
Valuation of tools January 1, 1899		465 3
Valuation of horse, wagons, etc., January 1, 1899		277 0
Valuation of furniture and fixtures, January 1, 1899		105 0
Total valuation of stock on hand January 1, 1899		$1,937 0
Valuation of meters in service January 1, 1898	$100,750 27	
Deduct 5 per cent for depreciation in value	5,037 51	
		$95,712 7
Add amount expended during the year for meters placed		7,091 5
Total valuation of meters in service January 1, 1899		$102,804 2
Cost of material used in repairing meters, 1898	$176 05	
Cost of labor repairing meters, 1898	971 15	
		$1,147 2
Less amount received for repairing meters		31 5
Total cost of repairs		$1,115 6

The following tables show in detail the work done by each engine each month of the year:

ENGINE No. 1.

MONTHS.	Time run.		Revolutions.	Gallons Water.
	H.	M.		
January	576	10	316,237	367,605,732
February	624	40	363,645	393,331,740
March	268	12	159,122	188,843,196
April	189	50	110,745	136,903,230
May	109	10	64,776	82,045,446
June	145	35	88,493	96,332,940
July	283	45	170,653	164,553,822
August	252	40	148,517	155,483,586
September	276	10	166,784	209,390,202
October	486	15	282,268	364,357,410
November	619	40	362,184	457,668,912
December	586	10	347,544	436,427,322
Total	4,418	17	2,580,968	3,052,943,538

ENGINE No. 2.

January	667	35	410,760	625,444,200
February	628	40	394,290	632,739,240
March	463	15	279,477	349,420,896
April	530	10	314,354	379,636,392
May	739	55	471,070	614,979,960
June	488	25	317,845	431,356,200
July	651	30	436,851	606,645,792
August	544	....	355,905	488,252,160
September	257	25	160,350	210,790,080
October	....	....	....	....
November	....	....	....	....
December	....	....	....	....
Total	4,970	55	3,140,902	4,339,264,920

ENGINE No. 3.

January	....	....	....	....
February	49	40	28,941	49,393,272
March	141	35	91,320	164,376,000
April	....	....	....	....
May	....	....	....	....
June	668	50	432,104	776,454,656
July	375	25	254,387	457,839,000
August	472	45	311,951	561,511,800
September	720	....	457,665	823,797,000
October	741	....	452,400	812,425,782
November	324	30	189,725	340,867,080
December	539	30	333,095	596,744,660
Total	4,033	15	2,551,538	4,583,409,200

ENGINE No. 4.

January	169	45	147,537	115,816,545
February	50	15	42,207	33,132,495
March	531	30	452,681	355,354,585
April	718	15	610,790	479,470,150
May	509	45	517,432	406,184,120
June	12	25	10,874	8,536,090
July	288	45	273,555	214,740,675
August	223	....	211,783	166,249,655
September	....	....	....	....
October	....	....	....	....
November	395	30	361,790	284,005,150
December	337	30	305,191	239,574,985
Total	3,326	40	2,933,840	2,303,064,400

TOTAL EXPENSE FOR PUMPING WATER.

Fuel, coal consumed	**$17,880 1**
Salaries, engineers et al	**19,096 8**
Engine oil and waste	**431 1**
Repairs, boilers and machinery	**490 5**
Supplies, soap, polish, etc	**142 7**
Supplies, valves, gaskets, packing, etc	**242 7**
Electric light supplies, etc	**138 7**
Farrier	**7 0**
Boiler inspection	**36 0**
Ice	**23 8**
Street car tickets	**10 0**
Horse expense	**67 6**
Total	**$38,567 5**

The cost of fuel per million gallons pumped is $1.25 and per million gallons pumped 100 feet high is $1.14.

The table shows that the water pumped during the yea was 14,278,682,058 gallons, an increase of 10 per cent compared with that of 1897.

The total expense for pumping water, heating and lighting was $38,567.52, making the cost per million $2.70, a decrease of 8 per cent from that of 1897.

All of the engines show a good average duty. No. 1 engine is in a good condition, excepting the foundation which will need some attention in the near future. No. foundation has been working loose for a number of years Repairs are now being made, so I expect it will prove satisfactory when given a trial.

I would recommend changing the H. P. cylinders o Nos. 1 and 2 engines, which I consider would increase th efficiency 15 per cent and would then be able to carry th same steam pressure on all boilers, thus making less complication in the pipe system generally.

No. 3 engine, which was stated in last year's report a being altered, as authorized by the Board, was completed in February, and has performed good service since. It is a pleasure to say that it fully came up to expectations, its efficiency being increased 20 per cent from that of former years, and also, during the warm weather, certain hours was run up to very near 35,000,000 gallons capacity.

The boilers in the west and middle rooms are in good condition; those in the east room, which are to be replaced by new ones, need no comments. The eave troughs on the engine house need some attention; otherwise the buildings are in good condition.

Respectfully submitted.

URIAH GOULD,
Chief Engineer at Pumping Works.

SPECIAL REPORT

OF THE

CIVIL AND CHIEF ENGINEERS

TO PROVIDE FOR THE PRESENT AND FUTURE NEEDS OF THE WATER CONSUMERS OF DETROIT.

To the Honorable Board of Water Commissioners of the City of Detroit:

Gentlemen—The following report is respectfully submitted in accordance with instructions received December 14, 1898.

In order to intelligently provide for the present and future needs of water consumers, a close examination of existing conditions is imperative. A careful study has been made of all available records and data relative to the growth and per capita consumption of Detroit for a period covering the last eighteen years.

For convenient reference the results obtained are put in tabular form as follows:

Year.	Whole number of persons actually supplied with water.	Increase of population in periods of 5 years.	Average daily gallons per consumer.	Maximum rate, daily gallons per consumer.	Daily gallons per consumer, meter.
1880	116,369	1880 to 1885 37,924	134		
1881	122,544		146		
1882	130,263		133		
1883	139,816		145		
1884	149 170		156		
1885	154,293		177		
1886	160,369	1885 to 1890 51,762	187		
1887	171,740		210		1.03
1888	182,840		215		1.35
1889	198,441		182		1.97
1890	206,055		161		8.32
1891	213,075	1890 to 1895 55,198	155		15.36
1892	225,040		152		19.32
1893	244,103		156	240	19.92
1894	252,056		149	262	19.52
1895	261,253		154	274	22.22
1896	275,099	1895 to 1900 55,747	132	219	22.55
1897	285,714		124	279	23.27
1898	294,580		133	265	25.80
1899				293	
1900	317,000				
		58,000			
1905	375,000				
		60,000			
1910	435,000				
		65,000			
1915	500,000				

The reduction in per capita consumption from 215 gallons, 1888, to the present average of about 130 gallons can be credited approximately as follows:

1. Saving due to meters about	45 Gals. per consumer daily
2. Economy at the pumps about	30 Gals. per consumer daily
3. Work of Inspectors, about	10 Gals. per consumer daily
Total reduction	85 Gals. per consumer daily

Nineteen and four-tenths per cent of all water pumped in 1898 was metered, and, as practically all the water used for manufacturing and business purposes is now metered, it is thought that little further reduction in the per capita consumption is likely to occur from this source, unless the meter service be extended to private houses. There has been no waste at the pumps since 1894, so that no further economy can be looked for from that quarter.

For the last three years the average daily consumption has been *130 gallons per person.* During this period the weather conditions have been, on the whole, favorable. The 1899 consumption is expected to reach 140 gallons, which is the least amount upon which it is safe to figure.

In a direct pressure system, such as the one under consideration, where there is no reservoir reserve, it is necessary to provide, not only for the average quantity of water used daily, but the pumps and mains must be of sufficient capacity to supply the maximum rate of consumption. Our records on this point extend only to 1893, and give the maximum daily per capita rate as follows:

1893—240 gallons per day.
1894—262 " " "
1895—274 " " "
1896—219 " " "
1897—279 " " "
1898—265 " " "
1899—293 " " "

Average..262 " " "

One engine should be held in reserve for use in case of accident or repairs, and as the per capita rate of 265 gallons per day has been exceeded in only three years out of seven, such occurrences can be treated as "accidents," to be taken care of by the reserve engine.

If, then, we provide pumps and mains of sufficient capacity to deliver 265 gallons per day to each consumer, and have in addition a reserve engine, all reasonable precautions will have been taken.

On this basis a new 24-million engine is required for each increase of 91,000 consumers, or a new 30-million engine for each 114,000.

From this it will be seen that number 3 engine was needed soon after the old works were discontinued in 1881, but was not completed until February, 1886.

During the intervening time there were 132 days when it was necessary to use the reserve engine, or 132 "accidents."

Engine No. 4 was needed as a reserve engine in 1890, but was not completed until March, 1894; in the meantime there were only 19 "accidents" of the kind mentioned.

A new engine (No. 5) was required in 1898, according to schedule, and we have already had two days, February 13 and 14, when all engines were in service, leaving no reserve.

At the present rate of increase in population a new 24-million engine will be required every seven years, or a 30-million every nine years.

One of the proposed new engines should have a capacity of 24 million gallons per day of 24 hours in order that the work required may be done with as little waste of fuel as possible.

There were two days in 1897, eight in 1898, and seven in 1899, to date, when the consumption exceeded the rated capacity of the three 24-million engines. On any one of these days an accident to the 30-million engine would hav made it impossible to pump the water required, leaving u practically dependent on one engine. For this reason th second engine should have a rated capacity of 30 millio gallons daily, and be so connected that it could take th place of No. 3 in case of accident. Both engines should b designed to withstand a water pressure of 100 pounds to th square inch.

When first installed they will be required to pum against a pressure of 60 to 75 pounds.

These engines, with foundations and steam and wate connections complete, will cost about $100,000 each.

The boilers already contracted for will be sufficient fo present needs; no further construction is required at thi time.

An extension to the Pumping Station on the east, su ficiently large to accommodate three engines, would cos about $38,000, and would leave a driveway only 38 feet wid between the end of the building and the fence on the easterl side of the grounds. A building large enough for two engines would cost about $27,000, and would leave a driveway 76 feet wide. The latter extension would be sufficien for the next fifteen years.

Change will be required in the brick well and condui which will cost about $4,500.00.

It is recommended that the high and low pressure systems be divided approximately along the 145-foot contou line which crosses Woodward avenue near Canfield avenu This can be accomplished, without creating dead ends, at total estimated cost of $5,500.00. The present consumptio in the high level district thus inclosed averages about 9,000,000 gallons daily, which will be increased to 11,000,000 wit the proposed higher pressure.

The maximum demand to be provided will be ver nearly twice the mean or 22,000,000 daily. This portio of the city is building up very rapidly, and it is estimated that at least one-fifth of the future increase in consumption will fall within the high level district.

The economical capacity of the present lines of pipe leading from the Pumping Station will soon be reached, and the existing line of 42-inch pipe in Mack avenue is not in condition to be utilized for the high pressure system. It is therefore recommended that a new line of 42-inch pipe be laid from the Pumping Station to the intersection of East Boulevard and Sylvester street, a distance of 14,154 feet, estimated cost of $127,386.00, continuing with a 36-inch line to Collins and Superior, 4,991 feet, at a cost of $38,214.00. In order to use the Mack avenue line, it will be necessary to lay an additional 2,019 feet of 36-inch pipe in Mack avenue from Collins to Chene street, thus connecting it with the lower system at an estimated cost of $17,000.00.

The necessary water connections in the pumping works grounds will cost about $15,000.00. A summary of costs is given as follows:

Summary of Cost.

1.	Two engines with foundations and connections		$200,000
2.	Buildings for three engines		38,000
3.	New main, 42 inch and 36 inch	$165,600	
	Changes in Mack Ave. line	17,000	
	Right of way	2,000	
	Connections at pumping station	15,000	
	Division of system	5,500	
	Change in brick conduit	4,500	209,600
	Total		$447,600

All of which is very respectfully presented.

(Signed) C. W. HUBBELL,
Civil Engineer.

URIAH GOULD,
Chief Engineer.

REPORT OF THE SUPERINTENDENT OF CONSTRUCTION.

Detroit, January, 1899.

To the Board of Water Commissioners:

Gentlemen—In obedience to the rules of your honorable body, I herewith present the annual report relating t the condition and progress of the Construction Department Being appointed by your honorable body as your Superintendent of Construction in the middle of the season, it becomes necessary for me to report the work done earlier i the year by my predecessor. At that time the greater portion of the work in the village of Delray had been executed What pipe remained unlaid consisted of the distribution pip in the extreme southwestern part of the village, lying between River street and Dearborn avenue; the 12-inch suction pipe, from the intersection of South street and Artillery avenue to its present terminus in the Solvay Process Company' grounds; the 10-inch main distribution pipe, from St. Clai street and Exposition avenue to the same terminus in th Solvay Process grounds, together with the hydrant connections throughout the village. The above work was practically finished by the middle of September.

Pumping Works Grounds.

The 24-inch brick sewer which drained the Pumpin Station into the head of the ship canal was cut off from tha outlet and re-connected with 24-inch iron pipe to a brick we south of the stand pipe, through which a 24-inch iron pip runs from the stand pipe to the head of the ship canal. A addition of five feet was required to carry it through the foundation of the Belvedere now being erected at that point. A section of this pipe was cut out at the well and an old gate was set at the south side of the well by which a desirable amount of the heated water from the engines may be let into the canal, the balance of which is now conveyed in a 24-inch crock sewer to the lagoon. The outlet of this sewer was thought not to be well located, and in order to change its course 140 feet of the crock was taken up and relaid so as to extend across the north end of the lagoon, requiring an additional 120 feet of crock.

The outlet was divided into two branches of 18 inches each, and enter the lagoon about 75 feet from each other. By means of this outlet division a current is maintained at either side of the small island near the head of the lagoon. At these outlets, for the purpose of keeping them clean and to aid in cooling the water before discharging it into the lagoon, there were built two cooling basins into which the water is emptied from the sewers. The brims of these basins are raised about twelve inches above the water level of the lagoon, over which the water falls in wide, thin sheets.

Connected to the before-mentioned 24-inch iron drain, near the base of the stand pipe, an 8-inch iron pipe was laid to the west lake at a depth sufficient to drain the lake four feet four inches below its ordinary level. At the lake end of this pipe an 8-inch gate and overflow pipe was set in a brick well. From the northwest side of the west lake to the northwest side of the east lake an 8-inch iron pipe was laid, with gate, overflow and well, as at west lake. In laying this line we encountered one of the 42-inch force mains, over which we had to raise, and further on a 10-inch service pipe, over which we had again to pass, so that we can only draw out of this lake two feet eight inches of its water.

The drain from the fountains at the Hurlbut Memorial gate was found badly broken under the driveway, and at other places choked with roots. As far as these conditions were found to exist, the crock was removed and the drain reconstructed with 6-inch iron pipe. It will be seen that all the waste water from the different fountains, as well as the surface water from the land surrounding and draining into the lakes, is carried through the above-mentioned pipes and discharged into the lagoon in a clean and fresh condition, the sewage having been entirely separated therefrom.

New Iron Sewer to River.

At the river and 115 feet out from the water's edge an 8-inch pipe was laid, running parallel with the west line of the Pumping Works grounds to a point 90 feet south of the engineer's barn, at which point the line turns east and in line to the engine house to a point opposite the stand pipe. From this point a 6-inch iron pipe was laid to and connected with the sewer pipes from the water closets in the engine room. From the end of the 8-inch pipe, opposite the stand pipe, a 6-inch pipe was laid to and connected with the sewer pipe coming from the water closets in the stand pipe. The above two sewer pipe connections were broken off from their former connections.

Another connection to the 8-inch pipe was made and a 6-inch pipe was laid to the new library and left for the plumbers to connect therewith. Another 6-inch pipe was laid from the engineer's barn and connected to the 8-inch pipe 90 feet south of same, and also with the sewer pipe from the engineer's house. Inside the barn, a 6-inch vent pipe was connected to sewer and carried up to and out through the roof for ventilating purposes. At two points in the

8-inch line parallel with west line of grounds, connections were placed for the future drainage of two public lavatories. A brick gate-well was built at the point where the 8-inch pipe turns east, in which were placed a 6-inch water gate and an 8-inch sewer gate; these are to be operated alternately when flushing the sewer.

To complete the above line of sewerage, there is yet to be laid about 385 feet of 8-inch pipe on the bed of the river from the end of the 115 feet already laid. This was left in the fall because it was thought that the pipe could be worked with less difficulty from the ice, and in the hope that the old steamboat M. D. Ward would be by that time removed.

From a 12-inch crock sewer on the north side of Jefferson avenue a 6-inch iron pipe sewer was laid to the centre of the Hurlbut Memorial gate and branched either way and through the foundations, for the purpose of draining proposed lavatories to be placed therein.

Water Service Pipe.

From the base of stand pipe east side and running south 59 feet, a 6-inch pipe was laid. From this point running west, and parallel to the 8-inch sewer pipe above mentioned, a 6-inch pipe was laid to the brick gate-well south of the engineer's barn, at which point it was connected to the 8inch sewer pipe. Here a 4-inch branch was conected running south, parallel with the west line of the grounds, 1,205 feet, with branches set at the points above mentioned for public lavatories.

The above was performed under the direction of Donaldson & Myers, architects, and by order of the Committee on Pumping Works.

The largest main line laid the past year was for the purpose of supplying the village of Delray, beginning with a 20-inch pipe at the west line of Vinewood avenue, running west on Porter street 287 feet, here reduced to a 16-inch pipe and continued through Clark Park and Porter street to Cavalry avenue, 4,390 feet, south on Cavalry to Army avenue, 218 feet; west on Army to Artillery avenue, 1,129 feet; here again reducing to a 12-inch pipe and turning south on Artillery avenue and east of the western city limits to South street, in the village of Delray, 3,419 feet; then west on South street to Exposition avenue, 3,607 feet; again south on Exposition avenue to River street, 1,300 feet; west on River street to a point 97 feet west of Crossley avenue, 422 feet. From this point it turns south into the Solvay Process Company's grounds, 887 feet. Here the line stops temporarily, about 270 feet from where the village authorities are about to erect pressure pumps. Until these are in position the line cannot be completed. The total length of this line is $3\frac{89}{5280}$ miles. All of the material for this uncompleted section is on the ground except the special castings required to connect the pipes with the pumps. These pieces cannot be made until the pumps are permanently placed.

Parallel with the above 12-inch pipe, a 10-inch distribution pipe was laid in the Solvay Process Company's grounds, on River street and Exposition avenue, to South street. At this point it branches east and west. Through this pipe the village is to receive its entire supply of water.

The whole amount of pipe laid for distribution the past year amounts to $28\frac{3999}{5280}$ miles, of which $12\frac{5148}{5280}$ miles were laid in the village of Delray and 4,216 feet in the township of Grosse Pointe. Total amount laid outside the city, $13\frac{4084}{5280}$ miles, and $14\frac{5195}{5280}$ miles within the city limits. The Board now owns $31\frac{980}{5280}$ miles of pipe outside the limits of the city. The total amount of pipe discontinued was $1\frac{5043}{5280}$ miles, of which $1\frac{4338}{5280}$ miles was within the city and 705 feet in the village of Delray, all of which was replaced by pipe of larger caliber.

Thus there is a net increase of the distribution system of $26\frac{4221}{5280}$ miles.

The total mileage of the distribution system is $553\frac{1784}{5280}$ miles. This is shown in the following table, in the different sizes of which it is composed:

SIZE OF PIPE IN INCHES.	MEASURED LENGTH IN FEET FOR 1897.	ADDED LENGTH IN FEET FOR 1898.	DISCONTINUED LENGTH IN FEET FOR 1898.	TOTAL LENGTH IN FEET FOR 1898.
45	103			103
42	59,491			59,491
36	715			715
30	54,494			54,494
24	84,587			84,587
20	106	287		393
18	87			87
16	48,068	5,737		53,805
12	27,595	9,632		37,227
10	148,555	10,508		159,063
8	296,298	15,679	52	311,920
6	1,211,422	93,268	984	1,303,706
4	780,394	16,590	7,814	789,170
3	65,388	123	1,473	64,038
2	2,829			2,820
Total,	2,780,123	151,824	10,323	2,921,624

I notice in last year's report of my predecessor that there were connected with the system, for fire protection, 3,002 hydrants and 549 reservoirs. In addition to the above, 104 tees have been set during the year for the Fire Department, to which may be connected hydrants or reservoirs at their option.

At the close of this report will be found a descriptive account of the lines of pipe laid the past year, giving the location, lengths, sizes and cost in detail.

Early in the present year the Board directed that to the cost of all extensions made outside of the city, or on private account, or where the cost is to be assessed upon abutting property, should be added a percentage for surveys, plans, supervision and superintendence. It was also ordered that over each gate, in place of the common gate box, a brick gate well should be hereafter constructed. These changes naturally increased the cost of construction. It will be borne in mind, too, that as to all extensions, the cost of which is assessed upon abutting property, the expense of advertising is added. I also submit the inventory of property at the storage yard as furnished by Wm. A. Burke, storage-keeper.

Gates.

The total number of gates now in the distribution system amounts to 6,624 of the different makes and sizes, as follows:

GATES IN SYSTEM JANUARY 1ST, 1899.

	42-In.	36-In.	30-In.	24-In.	20-In.	18-In.	16-In.	12-In.	10-In.	8-In.	6-In.	4-In.	3-In.	Total.
Murdock	5	...	11	16	...	...	27	46	183	460	1,636	1,327	10	3,721
Flowers	20	...	9	18	...	...	...	...	39	52	240	429	21	828
Galvin	...	1	7	12	...	...	21	...	13	31	171	258	1	515
Michigan Brass and Iron Works	10	...	9	2	11	...	12	11	57	151	767	110	...	1,140
Pittsburg	...	...	...	15	...	2	1	1	9	11	30	126	...	195
Roe Stephens	...	...	...	...	...	...	...	6	...	4	43	...	...	53
Eddy	...	...	...	...	...	...	...	...	15	4	6	9	...	34
Scowden (Scott)	...	...	...	...	...	...	...	...	3	19	44	...	...	66
Ludlow	...	...	...	...	...	...	...	...	1	2	10	10	...	23
Prong	...	...	...	...	...	...	...	...	...	...	1	...	...	1
Boston	...	...	...	...	...	...	...	...	...	1	1	...	...	2
Newport	...	...	...	...	...	...	...	...	...	...	...	1	...	1
No Name	...	...	...	...	...	...	...	...	...	3	9	32	1	45
Total	35	1	36	63	11	2	61	64	320	738	2,958	2,302	33	6,624

There were added to the system during the year 1898 302 gates, as shown by the following tables:

GATES SET.

GATES SET IN CITY.	3-in.	4-in.	6-in.	8-in.	10-in.	12-in.	16-in.	24-in.	30-in.	Total
Murdock	1	18	87	7	2	5	3	....	....	123
Scott	....	....	41	11	....	....	....	....	....	52
Pittsburg	....	....	....	....	....	....	....	2	....	2
Michigan Brass & Iron Works	....	1	1	....	1	....	2	....	....	5
Total	1	19	129	18	3	5	5	2	...	182
GATES SET IN DELRAY.										
Murdock	....	25	55	14	12	6	....	....	....	112
Michigan Brass & Iron Works	....	1	....	....	1	....	....	....	....	2
Scott	....	....	....	2	....	....	....	....	....	2
Total	....	26	55	16	13	6	....	....	....	116
GATES SET IN GROSSE POINTE.										
Murdock	....	....	4	....	....	....	....	....	....	4
Total	....	....	4	....	....	....	....	....	....	4

There were taken out of the system 71 gates, as shown by the following table:

TABLE OF GATES TAKEN OUT OF SYSTEM.

No. of each kind.	KIND.	SIZE.	REMARKS.	
1	Murdock	8-in.	Shut-off	System.
1	Galvin	8-in.	"	"
1	Ludlow	8-in.	"	"
7	Murdock	6-in.	"	"
1	Michigan Brass and Iron Works	6-in.	"	"
1	Ludlow	6-in.	"	"
1	Murdock	6-in.	Blow-off	"
1	Michigan Brass and Iron Works	6-in.	"	"
16	Murdock	4-in.	Shut-off	"
6	Flowers	4-in.	"	"
7	Galvin	4-in.	"	"
2	Ludlow	4-in.	"	"
15	Murdock	4-in.	Blow-off	"
5	Flowers	4-in.	"	"
3	Michigan Brass and Iron Works	4-in.	"	"
1	Galvin	4-in.	"	"
1	Pittsburg	4-in.	"	"
1	Flowers	3-in.	Shut-off	"
71				

The number of gates set for blow-offs the past year amounts to 79. There are now in the system 382 dead ends, all of which are provided with gates and are operated periodically to blow out the stagnant water. There are 43 other blow-offs connected with the sewers in various locations for use in flushing the mains of the system.

BLOW-OFFS ON DEAD ENDS OF PIPE.

No. of each kind.	GATES SET AND RE-SET FOR BLOW-OFFS.	SIZE.	REMARKS.
7	Murdock	12-in.	Set New.
8	"	8-in.	" "
4	Scott	8-in.	" "
7	Murdock	6-in.	" "
1	"	6-in.	Re-set.
8	Scott	6-in.	Set New.
38	Murdock	4-in.	" "
11	"	4-in.	Re-set.
2	Flowers	4-in.	Set New.
1	"	4-in.	Re-set.
1	Pittsburg	4-in.	"
1	Michigan Brass and Iron Works	4 in.	"
79	Total.		

Of the 43 blow-offs above referred to, 13 were built late in the past season, the following table showing their location and cost of construction in detail. These were all connected with the large mains and sewers for flushing purposes, and operated during the month of December, giving excellent results. For further particulars, see report of the Civil Engineer.

Date.	LOCATION OF PIPE.	Feet.	Size.	COST OF CONSTRUCTION.												
				Pipe.	Specials.	Lead.	Gates.		Sundries.	Brick.	Cement	Sand.	Crushed Stone.	Cartage.	Labor.	Total Cost.
							No.	Cost.								
Oct. 14.	Vinewood and Fort.......	14	8 in.	$7 92	$40 07	$7 36	8 M	$11 00	$2 08	$8 39	$3 00	$2 00	....	$15 06	$72 17	$169 05
Oct. 15	Fourth and Abbott.....	40 22	8 in. 4 in.	18 19	22 38	9 61	4 M 8 S	15 00	4 35	7 09	3 25	1 80	....	7 60	194 80	284 07
Oct. 24.	Sixth and Bagg	27	8 in.	9 72	23 55	7 36	8 M	8 50	1 43	6 05	3 75	4 00	$2 00	12 00	109 51	187 87
Oct. 31.	Woodward and Atwater	28 11	12 in. 3 in.	18 89	17 98	5 32	12 M	20 00	1 43	4 68	3 00	3 00	1 50	10 80	57 77	144 37
Nov. 7.	Jefferson and Second	....	....	....	14 49	3 68	12 M	20 00	2 26	4 95	2 75	2 20	1 00	7 10	27 72	86 15
Nov.15.	Hastings and Larned...	27 8	12 in. 4 in.	18 08	30 36	9 20	12 M	20 00	4 21	14 03	6 25	5 20	1 50	13 25	116 69	238 77
Nov.28.	Orleans and Fort....... (Two Gates.)	24 3 ft. 6 in. 12	12 in. 8 in. 4 in.	17 70	28 17	11 04	8 S 12M	32 00	4 01	8 25	3 50	3 00	....	10 25	128 79	246 71
Dec. 3.	Twenty-fourth and Michigan	15 3	12 in. 6 in.	9 42	30 64	9 20	12 M	40 00	2 53	11 00	4 25	2 60	....	10 25	88 11	208 00
Dec. 7.	Gratiot and Miami	13 5	12 in. 16 in.	13 30	29 58	7 36	12 M	20 00	4 69	3 30	4 00	1 20	3 00	18 00	95 93	200 36
Dec. 12.	Orleans and Woodbridge	2 ft. 6 in. 9 ft. 6 in.	10 in. 8 in.	4 58	16 92	3 68	8 M	7 50	2 85	5 50	3 50	2 60	....	7 70	59 45	114 28
Dec. 19.	Orleans and Mullett.... (Two Gates.)	2 ft. 8 in. 10 2 ft. 6 in.	24 in. 12 in. 8 in	9 99	60 86	11 04	8 S 12M	31 00	5 46	6 05	4 00	4 40	2 25	24 00	175 07	334 12

The following is a statement of work of the men employed in the examinations, operations and repairs of gates, gate-wells, etc.:

5,376	gates were examined.
85	gates were reported out of order Jan. 1st., 1898.
601	gates were reported out of order since Jan. 1st, 1898.
358	gates were repaired.
5	gates were found shut and opened.
21	gates were fitted with larger heads to stem.
218	gate wells were built over gates on new lines.
146	gate wells were built over gates on old lines.
4	gate wells were enlarged.
48	gate wells and covers were repaired and adjusted to grade of street.
473	gate wells were cleaned.
14	wood boxes were replaced with iron boxes.
285	boxes were readjusted to grade of street.
6,636	blow-offs were operated for blowing off dead ends.
580	gates were shut and opened for flushing.
1,424	gates were shut and opened for various purposes.
47	blow-offs were repaired.

Total and average cost of wells built on old lines:

	Total Cost.	Average Cost.
26 24″ gate wells	$2,760 15	$106 15
8 16″ gate wells	655 47	81 93
31 10″ gate wells	1,064 62	34 34
81 4″-6″-8″ gate wells	2,351 38	29 03

Total and average cost of wells built on new lines:

	Total Cost.	Average Cost.
218 wells	$3,719 08	$17 06

PIPE LAID IN PUMPING-WORKS GROUNDS FOR DRAINAGE PURPOSES.

LOCATION OF PIPE.	No. of Feet.	Size of Pipe.
From south of stand-pipe to west lake	179	8 in.
" " " " " " "	14	6 in.
Reconnecting brick sewer	35	24 in.
Extending drain from stand-pipe to canal	7	24 in.
From west lake to east lake	513	8 in.
" " " " " "	12	6 in.
From east lake to entrance gate	140	6 in.
From lavatories at gate to sewer in Jefferson avenue	130	6 in.
From river to a point 85 feet south of engineers' barn	1,520	8 in.
From 160 feet south of stand-pipe to 85 feet south of engineers' barn	479	8 in.
From 8-inch pipe south of stand-pipe to lavatory in stand-pipe	166	6 in.
From 8 inch pipe to engine room	170	6 in.
From 8-inch pipe to library	73	6 in.
From 8-inch pipe south of engineers' barn to barn including vent	136	6 in.

GATES SET IN DRAINAGE SYSTEM IN PUMPING-WORKS GROUNDS.

LOCATION OF GATE.	Number.	Make.	Size.
Set in well 85 feet south of engineers' barn	1	Murdock	6 in.
Set in well 85 feet south of engineers' barn	1	"	8 in.
Set in east lake drain to west lake in well.	1	"	8 in.
Set in west lake drain to 24-inch sewer south of stand-pipe in well	1	"	8 in.
Set on 6-inch branch at two points of toilet pavilion between west line of grounds and lagoon	2	"	6 in.
Set in brick well south of the stand-pipe..	1	Pittsburg	30 in.

PIPE LAID IN 1898.

Date.	LOCATION OF PIPE.	Feet	Size.	COST OF CONSTRUCTION.												
				Pipe.	Advertising.	Specials.	Lead.	Gates.		Sundries.	Gate-wells.	Hauling.	Repaving	Sup. & Eng.	Labor.	Total Cost.
								No.	Cost.							
July 6	A st., from 24 ft. w. of e. of Hubbard to 27 ft. w. of e. of Vinewood	461	8 in.	$ 168 48		$ 13 93	$ 22 08	1	$ 7 50	$ 3 60	$ 17 93	$ 12 00			$ 278 61	$ 524 13
Nov. 25	Anthon st., from 340 ft. w. of w. to 522 ft. w. of w. of Campbell	184	6 in.	46 80		75	3 68	1	4 00	51		5 25		18 30	28 35	107 64
June 9	Antoinette st., from 29 ft. w. of e. of 13th to 16 ft. e. of w. of 12th	372	6 in.	80 82	5 35	99	12 20	1	6 50	2 84	17 32	7 95		8 10	47 18	189 25
Aug. 12	Army ave., from 16 ft. e. of w. to 24 ft. e. of w. of Cavalry	8	6 in.													
Aug. 15	Army ave., from 16 ft. e. of w. of Cavalry to 31 ft. w. of e. of Artillery	1,129	16 in.	1,156 68		57 75	202 40	3	70 50	16 30	67 78			118 30	239 98	1,963 57
July 26	Avery ave., from 27 ft. n. of s. of Piquette to 24 ft. s. of n. of Milwaukee	884	6 in.	234 00	18 06	42 18	25 76	2	13 00	2 80	31 66	15 00		26 52	296 70	666 80
Aug. 15	Artillery ave., from 25 ft. s. of n. of Army to 25 ft. s. of n. of South.	3,419	12 in.	2,147 04	22 16	72 54	320 16	9	102 50	10 62	48 92			168 65	659 40	3,551 99
April 26	Baltimore ave., from 42 ft. e. of w. of Woodward to 4 ft. w. of w. of Brush	1,350	6 in.	352 56		21 28	39 19	1	8 00	12 60	21 50	26 50	185 27		615 93	1,282 84
May 24	Beaubien st., from n. line of Adelaide to 16 ft. n. of s. of Brewster	708	6 in.	164 08		21 25	29 60	4	22 00	1 83		21 50	62 00		480 24	815 16
April 22	Bellevue ave., from 97 ft. n. of n. of Frederick to 29 ft. n. of s. of Ferry	661	6 in.	174 72	18 31	20 46	19 69	1	8 00	1 30		19 52	15 50	19 84	129 26	426 60
June 15	Bellevue ave , from 277 ft. n. of n. of Stuart to 28 ft. n. of s. of Gratiot	575	6 in.	149 76	18 47	4 12	16 20	1	6 50	1 03		14 83	25 50	17 25	123 44	377 10
Sept. 1	Bewick ave., from 54 ft s. of n. of Jefferson to 9 ft. s. of s. of Kercheval (Grosse Pointe)	1,208	6 in.	315 12		14 85	44 16	3	18 50	2 03		27 50		36 34	264 63	723 03
Aug. 11	Burns ave., from 6 ft. s. of n. to 3 ft. n. of s. of Mack	57	6 in.	14 82			1 64			12		2 50			11 63	30 71
June 21	Cadillac Boulevard (e. side), from 15 ft. s. of n. of Kercheval to 40 ft. n. of n. of Jefferson	1,447	6 in.	390 00	18 47	9 52	45 36	1	6 50	2 69	31 32	34 50		44 94	418 47	1,001 77
June 24	Cadillac Boulevard (w. side), from 768 ft. n. of n. to 4 ft. n. of n. of Jefferson	795	6 in.	225 92	18 47	19 55	22 68	2	13 00	1 68	33 68	17 50		23 85	217 05	503 38
April 29	Cameron ave., from 27 ft. s. of n. of Philadelphia to 23 ft. n. of s. of Haigh	450	6 in.	113 88	11 10	6 49	13 50	1	8 00	3 85	16 07	5 75		13 59	91 53	283 76

PIPE LAID IN 1898—CONTINUED.

Date.	LOCATION OF PIPE.	Feet.	Size.	COST OF CONSTRUCTION.												
				Pipe.	Advertising.	Specials.	Lead.	Gates.		Sundries.	Gate-wells.	Hauling.	Repaving	Sup. & Eng.	Labor.	Total Cost.
								No.	Cost.							
June 4	Cameron ave., from 30 ft. s. of n. of King to 33 ft. n. of s. of Holbrook ..	440	6 in.	$112 32	$4 67	$1 20	$11 08	1	$6 50	$ 75	$16 80	$6 50	....	$13 02	$101 38	$274 22
Oct. 14	Campau st., from 39 ft. s. of s. of Wolf to 22 ft. s. of n. of Toledo	755	6 in.	193 44	26 82	7 59	22 00	1	6 50	1 74	15 58	12 50	....	22 11	125 44	443 72
June 15	Columbus ave., from 17 ft. s. of n. of River to 336 ft. n. of n. of same.....	353	6 in.	89 35	9 45	2 30	9 07	....	....	56	....	6 72	......	10 59	116 49	243 90
June 1	Crystal st., from 33 ft. s. of n. of Trombley to 24 ft. s. of n. of Milwaukee	536	6 in.	140 40	....	8 91	15 00	2	13 00	4 01	15 50	14 20	... ...	16 08	243 35	470 45
Aug. 10	Cavalry ave., from 21 ft. s. of n. of Porter to 25 ft. s. of n. of Army.....	218	16 in.	226 44	18 47	51 27	44 16	....	....	2 78	....	4 50	....	22 00	44 56	414 18
Aug. 12	Cavalry ave., from 20 ft. s. of n. of Army to 28 ft. s. of n. of Howard...	108	6 in.	34 42	20 31	4 11	3 68	2	13 00	....	15 26	4 50	......	11 60	18 51	125 40
June 4	Crane ave., from 20 ft. s. of n. of Mack to 1,001 ft. n. of n. of same..........	1,021	6 in.	189 20	16 45	5 20	27 00	2	12 00	1 64	18 24	18 50	....	30 63	212 94	531 86
May 26	Custer ave., from 30 ft. w. of e. of Brush to 23 ft. w. of e. of Beaubien.	370	6 in.	93 60	....	13 44	12 24	1	6 50	3 71	....	12 50	....	....	118 79	260 78
May 25	Columbia, from 27 ft. w. of e. to 20 ft. w. of e. of Rivard..................	7	6 in.	....	....	......	....	....	......	......	......	......	......	......	......	....
Aug. 26	Concord ave., from s. line of Harper to 15 ft. s. of n. of same............	53	6 in.	....	....	......	....	....	......	......	......	......	......	......	......	....
June 29	Clark ave., at Porter reconnecting with 16-in. main...	6	8 in.	....	....	......	....	....	......	......	......	......	......	......	......	....
Aug. 11	Campbell ave., at Porter reconnecting with 16-in. main....................	13	6 in.	....	....	......	....	....	......	......	......	......	......	......	......	....
May 23	Dry Dock st., from 18 ft. w. of e. of Swain's to 24 ft. e. of w. of Pleasant	319	6 in.	78 00	....	9 24	10 61	2	13 00	80	23 20	11 50	......	......	110 24	257 59
Aug. 16	Dragoon ave., reconnecting with 16-in. main at Army.....................	16	6 in.	....	....	......	....	....	......	......	......	......	......	......	......	....
Nov. 16	Elsa st., from 17 ft. e. of w. of McClellan to 25 ft. e. of w. of Pennsylvania..............................	712	6 in.	184 08	19 46	6 73	22 08	1	6 50	83	13 38	18 50	....	35 60	144 45	451 61
May 7	Farnsworth st., from 12 ft. w. of w. of Collins to 35 ft. e. of w. of McDougall	466	6 in.	118 09	18 09	1 25	9 04	....	....	49	....	12 50	......	14 01	112 54	286 48
July 21	Frederick st., from 124 ft. e. of e. of Moran to 440 ft. e. of e. of same.....	316	6 in.	84 24	17 73	....	7 36	....	......	50	....	6 50	....	9 48	68 65	194 46

July 7	Ferdinand st., at Porter connecting 6-in. and 16-in.	6	6 in													
May 6	G. A. R. st., from 26 ft. e. of w. of Welsh to 17 ft. w. of e. of Howell	470	6 in.	121 68	14 97	10 06	15 19	2	16 00	1 07		12 50		14 10	122 74	328 13
Sept. 8	Garfield ave., from e. line of Moran to 25 ft. w. of e. of Ellery	445	6 in.	118 56	17 84	1 94	18 00	1	6 50	35	18 70	12 50		13 85	107 00	314 94
July 13	Gregorie st., crossing e. side of McClellan	40	6 in.	11 05		54	1 64			12					19 92	33 37
May 14	Hammond ave., from 79 ft. s. of s. of Otis to 479 ft. n. of n. of same	619	6 in	159 12	18 36	1 24	15 19	1	8 00	96	17 36	14 50		18 57	122 08	375 38
Mar. 19	Hamtramck st., from 25 ft. e. of w. of McClellan to 531 ft. e. of e. of same	572	6 in.	142 06	14 77	7 06	11 31	2	12 00	87	26 67	24 60		24 70	102 57	360 61
April 21	Harper ave., from 414 ft. e. of e. of VanDyke to 624 ft. e. of e. of same	210	6 in.	54 60		4 08	3 28			27					48 00	111 27
Aug. 26	Harper ave., from 14 ft. e. of w. of Concord to 13 ft. e. of w. of Sherwood	294	6 in.	74 88	8 86	5 13	7 85			15		8 00		8 82	72 60	186 51
Sept. 19	Harper ave., alley n. of, from 22 ft. w. of e. of Widman place to 2 ft. w. of e. of alley west	150	4 in.	22 80		5 65	4 85			38					15 25	48 93
Sept. 28	Harper ave., from 24 ft. e. of w. of Helen to 46 ft. w. of e. of Concord	614	6 in.	159 88	8 05		19 44	1	6 50	1 03		12 28		18 45	110 52	336 15
Sept. 26	Helen ave., from 22 ft. s. of n. of Mathews to 28 ft. n of s. of Kercheval	1,521	6 in.	399 36	17 57	70 80	51 24	2	13 00	4 87	31 14	29 50		45 63	289 43	882 51
Sept. 27	Helen ave., from 33 ft. s. of n. of Lambert to 14 ft. s. of n. of Harper	1,161	6 in.	301 88	16 07	3 51	20 64	2	13 00	94	40 26	22 22		34 83	214 20	607 55
Mar. 31	Hendrie ave., from w. line of Hastings to 12 ft. w. of e. of Beaubien	1,109	6 in.	288 60	21 38	27 79	29 48	2	16 00	1 62	41 66	23 50		33 27	217 86	701 16
Aug. 27	Hendrie ave., from 17 ft e. of w. of St. Aubin to 20 ft. e. of w. of Dubois	467	6 in.	124 80	18 09	5 26	18 00	1	6 50	1 15	22 90	14 50		14 01	112 64	337 95
Nov. 4	Hendrie ave., from 6 ft. e. of e. of Hastings to 18 ft. w. of e. of Rivard	764	6 in.	199 68	21 38	5 16	29 44	2	13 00	4 14	28 75	16 50		38 20	164 82	521 07
June 6	Holbrook ave., from 21 ft. w. of e. of Cameron to 24 ft. w. of e. of Russell	671	6 in.	174 72	9 36	5 22	21 00	1	6 50	75	16 30	12 00		20 13	185 65	451 63
June 28	Holbrook ave., from 24 ft. w of e. of Russell to 25 ft. e. of w. of Knox	698	6 in.	180 96	20 56	1 19	19 44	2	13 00	1 19	31 00	18 50		20 94	146 92	453 70
July 29	Holbrook ave., from 1 ft. e. of w. of Brush to 22 ft. w. of e. of Cameron	2,039	6 in.	526 42		4 34	55 20	3	19 50	50	49 52	38 50		61 17	453 30	1,208 45
July 13	Houghton st., crossing e. side of McClellan	40	6 in.	10 40		1 26	1 64			9					19 10	32 49
Aug. 12	Howard st., from 26 ft. w. of e. to e. line of Cavalry	27	6 in.													
Nov. 17	Hunt st., from 380 ft. w. of w. of Ellery to 25 ft. w. of e. of same	416	6 in.	109 20	17 99		12 88	1	6 50	65	15 68	11 50		20 80	71 19	266 34
May 19	Hurlburt ave., from 22 ft. n. of n. of Jefferson to 712 ft. n. of n. of Kercheval	2,020	6 in.	524 16	18 64	7 83	51 26	2	12 00	19 98	15 95	33 00			481 21	1,117 03

PIPE LAID IN 1898—CONTINUED.

Date.	LOCATION OF PIPE.	Feet	Size.	COST OF CONSTRUCTION.												
				Pipe.	Advertising.	Specials.	Lead.	Gates.		Sundries.	Gate-wells.	Hauling.	Repaving	Sup. & Eng.	Labor.	Total Cost.
								No.	Cost.							
June 25	Hubbard ave., at Porter under 16-in. main	8	6 in.	......	......	......	......	......	......	......	......	......	......	......	......	......
July 8	Hubbard ave., from 23 ft. s of n. of Michigan to 23 ft. n. of s. of A	36 458	6 in. 8 in.	$164 88	......	$13 23	$29 44	3	$20 50	$10 18	$17 98	$9 00	......	$13 50	$294 75	$573 41
Sept. 20	Ingersoll st., from 186 ft. e. of e. of Wesson to 20 ft e of w. of Greusel	359	6 in.	96 72	$18 91	5 89	14 72	1	6 50	1 16	13 95	9 50	......	10 77	92 05	270 17
Aug. 10	Iroquois ave., from ft. s. of n. to 5 ft. n. of s. of Mack	55	6 in.	14 30	......	27	1 64	......	......	12	......	......	......	......	15 75	32 08
Aug. 9	Junction ave., reconstruction of 8-in. pipe at Porter	19	8 in.	......	......	......	......	......	......	......	......	......	......	......	......	......
April 29	Kirby ave., from 30 ft. w of e. to 25 ft. e. of w. of Bellevue	15	6 in.	......	......	......	......	......	......	......	......	......	......	......	......	......
Nov. 12	Koch ave, from 20 ft. e. of w. of Cameron to 29 ft. e. of w of Oakland	662	6 in.	174 72	21 38	1 38	21 92	2	13 00	3 11	28 56	15 50	......	66 20	121 56	467 33
June 20	Kercheval ave., from 45 ft. e. of w. of Cadillac to 4 ft. w. of e. of same.	51	6 in.	13 06	......	2 63	......	......	......	......	......	......	......	......	......	......
May 20	Lafayette ave., from 20 ft. w. of e. of Tenth to 704 ft. w. of w. of same....	734	6 in.	190 32	......	11 73	25 64	1	6 50	2 44	18 25	16 50	......	......	309 76	581 14
July 7	Lansing ave., at Porter connecting with 16-in. main	14	6 in.	......	......	......	......	......	......	......	......	......	......	......	......	......
July 19	Mack ave., from 2 ft. e. of e. of Montclare to 24 ft. e. of w. of Schorr (Grosse Pointe)	270	6 in.	68 64	......	7 86	8 48	1	6 50	50	......	7 50	......	8 10	49 50	157 08
Aug. 5	Mack ave., from 30 ft. e. of w. of Baldwin to 25 ft. e. of w. of Beals...	515	6 in.	131 04	19 42	12 73	15 72	1	13 00	6 92	31 58	15 50	......	15 45	157 58	418 84
Aug. 5	Mack ave., from 55 ft. w of e. of Maxwell to 78 ft. e. of e. of Iroquois	775	8 in.	285 12	18 58	19 46	37 60	2	15 00	2 40	32 44	25 50	......	24 30	310 95	771 85
Aug. 8	Mack ave., from w. line of Seneca to 25 ft. e. of e. of Newland	389	8 in.	142 56	18 58	17 72	18 00	1	7 50	1 01	17 48	14 50	......	11 67	127 62	377 64
Aug. 9	Mack ave., from 16 ft. w. of e. of Rolf's place to 19 ft. e. of w. of McClellan	1,092	6 in.	287 04	26 18	13 12	36 80	4	26 00	9 46	62 10	25 50	......	32 82	265 19	784 21
Nov. 15	Mack ave., from 25 ft. e. of w. of Schorr to 25 ft. e of w. of O'Flynn (Grosse Pointe)	342	6 in.	90 48	......	3 21	11 04	1	6 50	70	......	9 50	......	17 30	59 73	198 46
May 14	Marston ave., from 1,724 ft. w. of w. of Oakland to 24 ft. w. of w. of same..	1,484	6 in.	386 88	16 45	8 44	33 52	......	......	1 92	......	20 00	......	44 64	304 58	816 38

July 13	**Mason st, crossing e. side of McClellan**	40	6 in.	10 40		1 41	1 64			16					19 10	32 71
April 6	**Maxwell ave., from 26 ft. s. of n. to 6 ft. s. of n. of Mack**	20	8 in.													
Aug. 9	Maxwell ave., from 26 ft. s. of n. to 6 ft. n. of s. of Mack	34	6 in.													
Oct. 5	McClellan ave., from 134 ft. s. of s. of Weyher to 48 ft. n. of s. of Sylvester	506	10 in.	285 20	3 75	12 67	19 92	1	15 00	1 52	15 92	9 50		25 30	97 71	486 49
Oct. 6	McClellan ave., from 48 ft. n. of s. of Sylvester (W.) to 12 ft. s. of n. of Buhl	1,106	8 in.	397 80	8 38	9 84	43 14	2	22 00	2 76	30 19	22 00		55 25	88 11	829 47
Oct. 10	McClellan ave., from 12 ft. n. of s. of Buhl to 31 ft. s. of n. of Chapin (E.)	3,601	6 in.	939 12	25 14	6 03	129 42	6	39 00	8 49	84 90	66 00		180 15	638 87	2,117 12
July 16	McGraw ave., crossing Grand River	60	6 in.	15 60		3 43	3 24			46					45 51	68 24
July 5	McKinstry ave., at Porter connecting with 16-in. main	11	6 in.													
April 12	McMillan ave., from 22 ft. e. of w. of Cavalry to 363 ft. e. of e. of same	393	6 in.	102 96		3 94	10 50	1	8 00	46	20 69	12 00		11 79	48 11	218 45
April 16	Military ave., at Army connecting with 16-in. main	4	6 in.													
May 28	Milwaukee ave., from 20 ft. e. of w. of Crystal to 35 ft. e. of w. of Russell	734	6 in.	193 32		9 14	27 60	2	13 00	3 76	31 00	17 95	158 80		280 69	735 26
Aug. 9	Morrell ave., connecting with 16-in. main at Porter	16	6 in.													
June 8	Mott ave., from 556 ft. e. of e. of Woodward to 22 ft. e. of w. of Oakland	2,094	6 in.	542 88	19 30	10 18	80 00	2	13 00	5 41	35 14	36 50		62 82	495 80	1,291 03
July 5	Mt. Elliott ave., from 21 ft. s. of n. of Milwaukee to 695 ft. n. of n. of same	716	6 in.	197 20		7 99	22 78	1	6 50	1 84		18 50	4 18	21 48	421 05	701 97
May 17	Norville st., from 24 ft. w. of e. of VanDyke to 576 ft. e. of e. of same	600	6 in.	152 88	17 81	5 92	15 09	2	12 00	98	16 51	11 50		18 03	128 31	379 03
June 9	Oakland ave., from 19 ft. s. of n. of Mack to 1,154 ft. n. of n. of same	400	10 in.	190 40	3 60	7 90		1	9 50		21 10	6 00		12 00	114 55	365 05
Nov. 15	O'Flynn ave., from 19 ft. s. of n. of Mack to 1,145 ft. n. of n. of same (Grosse Pointe)	1,165	6 in.	299 52		1 59	29 44		10 50	1 20		20 00		58 20	200 89	622 34
Aug. 18	Pallister ave., from 20 ft. e. of w. of Greenfield to 1 ft. e. of e. of Twelfth	1,295	6 in.	336 96	20 31		44 16	2	13 00	2 14	29 74			38 85	257 60	742 76
June 10	Palmer ave., from w. line of Hastings to 187 ft. e. of e. of Beaubien	878	6 in.	224 64	22 16	8 95	22 68	2	13 00	2 46	33 17	26 50		26 19	184 01	563 76
April 14	Park View ave., from 7 ft. s. of s. of Jefferson to 607 ft. s. of s. of same	603	6 in.	156 00		6 40	17 18			5 30		16 50		18 09	168 14	387 65
Aug. 31	Pennsylvania ave., from 145 ft. s. of Mack to 563 ft. s. of s. of same	418	6 in.	112 32	20 31	5 10	14 72			75		12 50		12 54	87 30	265 54
Aug. 31	Pennsylvania ave., from 856 ft. n. of Kercheval to 1,056 ft. n. of n. of same	194	6 in.	56 16	17 58		7 80			33		7 50		6 00	41 09	136 02
April 29	Philadelphia ave., from 400 ft. w. of w. of Cameron to 22 ft. w. of e. of same	443	6 in.	113 88	11 10	3 00	13 50	1	8 00	82	16 07	5 76		18 29	92 02	276 93

PIPE LAID IN 1898—CONTINUED.

Date.	LOCATION OF PIPE.	Feet	Size.	COST OF CONSTRUCTION. Pipe.	Advertising.	Specials.	Lead.	Gates. No.	Gates. Cost.	Sundries.	Gate-wells.	Hauling.	Repaving	Sup. & Eng.	Labor.	Total Cost.
Oct. 20	Philadelphia ave., from 2 ft. e. of e. of Woodward to 14 ft. e. of w. of Brush	1,327	6 in.	$349 44	$22 20	$ 63	$36 80	2	$13 00	$3 11	$30 23	$27 50	....	$66 35	$271 41	$819 67
April 25	Piquette ave., from 34 ft. e. of w. of Woodward to 23 ft. w. of e. of Brush	1,408	8 in.	505 44	....	14 27	45 68	3	27 00	9 16	51 60	26 00	$247 08	....	785 96	1,712 19
April 25	Piquette ave., from 23 ft w of e. of Brush to 22 ft. w. of e. of Beaubien.	356	6 in.	90 48	....	6 90	11 45	4	24 00	1 40	33 13	9 00	82 35	....	252 82	511 43
July 26	Piquette ave., from 30 ft. e. of w. of Commonwealth to 27 ft. e. of w. of Avery	353	6 in.	90 48	3 27	5 33	11 04	1	6 50	1 19	18 47	6 00	....	10 59	114 94	272 01
July 13	Pontiac st., crossing e. side of McClellan	40	6 in.	10 66	....	1 64	1 41	....	....	12	....	....	.. ..	......	19 35	33 18
June 24	Porter st., from 21 ft. w of e. of Vinewood to 248 ft. w. of w. of same ..	287	20 in.	5,020 40	22 16	425 02	691 84	....	783 00	158 97	472 72	101 27	......	233 25	6,108 29	14,016 84
June 24	Porter st., from 248 ft. w. of w. of Vinewood to 16 ft. e. of w. of Cavalry	4,390	16 in.													
Nov. 16	Pumping Works Grounds, to supply w. side of grounds	638 1,198	6 in. 4 in.	363 04	....	52 73	37 56	2	13 00	6 79	30 00	63 00	....	....	600 95	1,167 07
May 25	Rivard st., from 5 ft. n. of n. of Gratiot to 22 ft. s. of n. of Montcalm . ..	393	6 in.	103 02	....	10 93	16 00	1	6 50	2 05	22 12	12 18	....	....	312 72	485 52
May 26	Rivard st., from 21 ft. n. of s. of Brewster to ft. n. of n. of Wilkins.	416	6 in.	109 04	....	14 12	19 20	1	6 50	1 50	22 12	12 89	....	....	333 54	518 91
June 16	Rivard st., from 24 ft. n. of s. of Elliot to 23 ft. n. of s. of Watson	772	8 in.	280 80	.. ....	17 36	38 40	5	33 50	2 15	66 36	23 40	......	....	590 28	1,052 25
June 15	River st., from 21 ft. w. of e. of Columbus to 303 ft. e. of e. of same ..	325	8 in.	120 89	10 29	5 29	13 61	1	7 50	70	16 06	9 38	....	....	110 43	303 90
June 9	Rohns ave., from 1,290 ft. n. of n. of Mack to 30 ft. n. of s. of Canfield ...	672	6 in.	171 60	18 92	6 40	19 44	1	6 50	90	25 70	17 50	....	20 10	119 46	396 52
June 29	Russell st., from 33 ft. n. of s. of Holbrook to 18 ft. s. of w. of Alger	825	6 in.	212 16	10 64	15 21	23 00	2	13 00	1 26	31 31	14 00	....	24 75	214 22	559 55
April 7	Sargent st., from 3 ft. e. of e. of Collins to 349 ft. e. of e. of Moran......	1,068	6 in.	279 24	20 01	11 28	25 09	2	13 00	1 84	29 58	22 50	....	32 06	198 58	633 18
June 27	Scotten ave., at Porter connecting with 16-in. main	14	6 in.	....	....	....	....	....	....	....	.. ..	....	....	.. ...	... ...	....
July 18	Schorr ave., from 20 ft. s. of n. of Mack to 124 ft. n of same (Grosse Pointe)............................	1,231	6 in.	383 76	....	11 04	40 48	2	12 00	1 79	....	22 50	....	45 03	238 14	754 74

Aug. 16	Second ave., crossing n. side of Seward	30	6 in.	7 80	......	3 24	3 24	....	......	28	......	......	......	......	15 19	30 47
Aug. 15	Seward ave., from 180 ft. w. of w. of Hamilton Boulevard to 4 ft. e. of e. of Greenfield	1,050	6 in.	274 56	20 31	5 97	33 12	1	6 50	1 80	15 58	21 00	......	31 50	240 88	657 22
Aug. 9	Seminole ave., from 6 ft. s. of n. to 3 ft. n. of s. of Mack	57	6 in.	14 82	......	27	1 64	....	......	......	......	......	......	......	12 75	29 60
Oct. 17	Seventh st., alley e. of, from 20 ft. s. of n. of Pine to 96 ft. s. of s. of same	128	8 in	13 94	......	1 43	3 40	....	4 50	90	......	......	......	......	80 53	104 70
June 18	Seyburn ave., from 329 ft. n. of n. of Warren to 26 ft. n. of s. of Forest.	1,216	6 in	315 12	22 16	13 51	32 40	2	13 00	1 72	20 69	26 50	......	36 48	230 49	711 87
Aug. 25	Sherwood ave., from 12 ft. s. of n. of Harper to 445 ft. n. of n. of same	458	6 in.	121 68	13 30	4 47	15 75	2	12 00	1 02	15 18	10 50	......	13 89	103 89	311 68
Sept. 29	Sherwood ave., from 445 ft. n. of n. of Harper to 20 ft. n. of s. of Strong	688	6 in.	177 84	18 08	4 80	22 08	1	6 50	1 35	13 80	15 50	......	20 49	120 97	401 41
June 10	Stanley ave., from 29 ft. w. of e. of Wabash to 29 ft. w. of e. of Thirteenth	350	6 in.	85 96	9 37	7 04	13 00	1	6 50	......	17 32	8 15	......	11 82	127 02	286 18
Sept. 30	Strong ave., from 13 ft. e. of w. of Sherwood to 588 ft. e. of e. of same.	622	6 in.	159 12	19 16	5 25	18 04	2	12 00	1 66	13 80	15 50	......	18 75	101 99	365 27
Aug. 16	Third ave., crossing s. side of Seward	47	6 in.	12 10	......	3 24	3 24	....	......	28	......	......	......	......	18 34	37 20
Mar. 29	Thirtieth st., from 23 ft. s. of n. of Michigan to 20 ft. n. of s. of Visger.	467	6 in.	105 68	22 20	8 27	9 75	2	12 00	1 21	20 75	15 43	......	14 03	116 07	325 99
July 14	Thirtieth st., from 25 ft. s. of n. to 4 ft. n. of n. of Buchanan	28	6 in.	......	......	......	......	....	......	......	......	......	......	......	......	......
June 10	Thirteenth st., from 30 ft. n. of s. of Stanley to 28 ft. n. of s. of Antoinette	498	6 in.	107 78	15 18	3 16	16 40	1	6 50	......	17 32	10 40	......	17 82	155 13	349 69
Aug. 23	Tillman ave., from s. side of Hudson to 151 ft. s. of Kirby.	651	6 in.	168 48	18 63	4 95	22 08	....	......	7 23	......	16 50	......	19 53	183 00	440 40
Sept. 7	Townsend ave., from 10 ft. n. of n. of Palmer to 3 ft. n. of s. of Hendrie	406	6 in.	106 08	16 89	5 46	10 80	2	12 00	55	16 25	11 50	......	12 18	59 90	251 61
May 28	Trombley ave., from 27 ft. w. of e. of Russell to 20 ft. e. of w. of Crystal	732	6 in.	190 44	......	14 13	27 60	1	6 50	3 76	15 52	17 95	......	21 96	288 02	585 88
May 5	Twenty-fifth st., from 18 ft. n. of s. of Howard to 31 ft. s. of n. of Lafayette	430	6 in.	112 32	16 45	10 88	12 11	2	13 00	95	19 41	13 50	......	12 90	101 39	312 91
Sept. 17	Vienna st., from 4 ft. w. of w. of Second to 3 ft. e. of e. of same	157	6 in.	40 04	......	6 58	6 48	1	6 50	65	17 25	......	......	4 71	45 77	127 98
May 9	Warren ave., e. 33 ft., e. of w. of John R. to 39 ft. w. of e. of Woodward	669	6 in.	171 60	......	8 24	22 84	2	16 00	1 50	35 04	18 50	96 37	20 07	319 93	705 09
June 9	Westminster ave., from w. line to 22 ft. e. of w. of Oakland	22	6 in.	......	......	......	......	....	......	......	......	......	......	......	......	......
May 27	Wilkins st., from 19 ft. w. of e. of Rivard to 23 ft. e. of w. of Russell	405	6 in.	106 08	......	3 08	18 23	2	12 00	77	14 74	7 50	......	......	327 07	490 33
April 6	Worcester st., from 34 ft. w. of e. of Parker to 15 ft. w. of e. of Maxwell.	318	6 in.	78 00	6 85	2 35	5 95	1	8 00	38	21 10	6 50	......	9 57	54 86	193 56
Aug. 22	Williams ave., from 4 ft. n. of n. of Warren to 48 ft. n. of s. of Merrick	827	6 in.	218 40	17 54	......	22 08	1	6 50	1 56	16 38	20 50	......	24 81	198 44	526 21

Pipe Laid in the Village of Delray in 1898.

15,273 feet	4-inch
27,448 feet	6-inch
9,955 feet	8-inch
9,602 feet	10-inch
6,230 feet	12-inch
68,508 feet, Total.	

COST OF CONSTRUCTION.

Pipe	$21,994 04
Gate-Boxes	324 50
Specials	813 06
Lead	2,813 07
Gates	1,253 80
Lead-Pipe	284 89
Sundries	694 12
Meters	722 00
Gate-Wells	153 73
Hauling	749 18
Sup. & Eng	1,329 61
Labor	17,429 06
Total cost	$48,560 66

All of which is respectfully submitted.

LUKE CROSSLEY,
Superintendent of Construction.

SUPPLEMENT.

BOARD OF MANAGEMENT OF DETROIT WATER WORKS.

Board of Trustees appointed by Common Council, February 24th, 1852; organized March 1st, 1852.

Shubael Conant, Chairman. Edmund A. Brush.
Henry Ledyard. Wm. R. Noyes.
Jas. A. Van Dyke.

1853.

On the 16th of May, 1853, the Board of Water Commissioners of the City of Detroit was organized under an act previously approved by the Common Council and passed by the Legislature, February 14th, 1853. The term of service was determined by lot, as follows:

Jas. A. Van Dyke,	for 3 years.
Edmund A. Brush,	for 4 years.
Henry Ledyard,	for 5 years.
Shubael Conant,	for 6 years.
Wm. R. Noyes,	for 7 years.

Shubael Conant was elected President, who, finding the duties too arduous, resigned July 30th, and Edmund A. Brush was elected.

1854.

Edmund A. Brush, President. Jas. A. Van Dyke.
Shubael Conant. Wm. R. Noyes.
Henry Ledyard.

1855.

Edmund A. Brush, President.
Henry Ledyard.
Shubael Conant.
William R. Noyes.
James A. Van Dyke, died May 8th.
A. D. Fraser, appointed to fill vacancy.

1856.

Edmund A. Brush, President.
Shubael Conant.
Wm. R. Noyes.
Alexander D. Fraser, re-appointed May 1st, for 5 years.
Henry Ledyard.

1857.

Edmund A. Brush, President, re-appointed May 1st, for 5 years.
Henry Ledyard.
Alexander D. Fraser.
William R. Noyes.
Shubael Conant.

1858.

Edmund A. Brush, President.
Shubael Conant.
Alexander D. Fraser.
Henry Ledyard, re-appointed May 1st, for 5 years.
Wm. R. Noyes.

1859.

Edmund A. Brush, President.
Alexander D. Fraser.
Wm. R. Noyes.
Shubael Conant, term expired May 1st, and
Julius D. Morton, appointed for 5 years.
Henry Ledyard, vacated by moval from city, and
John V. Ruehle, appointed May 1st to fill vacancy.

1860.

Edmund A. Brush, President.
Alexander D. Fraser.
Julius D. Morton.
William R. Noyes, re-appointed May 1st, for 5 years.
John V. Ruehle.

1861.

Edmund A. Brush, President.
Alexander D. Fraser, re-appointed May 1st for 5 years.
Jno. V. Ruehle, resigned Sept. 16th, and
Chauncey Hurlbut appointed to fill vacancy.

1862.

Edmund A. Brush, President, re-appointed May 1st, for 5 years.
Wm. R. Noyes.
Julius D. Morton.
Chauncey Hurlbut.
Alexander D. Frazer.

1863.

Edmund A. Brush, President.
Alexander D. Frazer.
Wm. R. Noyes.
Julius D. Morton.
Chauncey Hurlbut, term expired May 1st, and
Stanley G. Wight, appointed for 5 years.

1864.

Edmund A. Brush, President.
Alexander D. Frazer.
Wm. R. Noyes.
Julius D. Morton, term expired May 1st.
Stanley G. Wight.

1865.

Edmund A. Brush, President.
Wm. R. Noyes, resigned Jan. 10, and Jacob S. Farrand appointed to fill vacancy, Term expired May 1st. Re-appointed for 5 years.
Alexander D. Frazer.
Stanley G. Wight.
Julius D. Morton, re-appointed for 5 years from May 1st, 1864. Died Feb. 1865, and Jno. Owen appointed to fill vacancy.

1866.

Edmund A. Brush, President.
Alexander D. Fraser, re-appointed May 1, for 5 years.
Stanley G. Wight.
Jacob S. Farrand.
Jno. Owen.

1867.

Edmund A. Brush, President, re-appointed May 1, for 5 years.
Alexander D. Fraser.
Jacob S. Farrand.
Jno. Owen.
Stanley G. Wight.

1868.

*Edmund A. Brush, President.
Stanley G. Wight, term expired May 1, and
Chauncey Hurlbut appointed for 5 years.
Jacob S. Farrand.
John Owen.
Caleb Van Husan.

*Edmund A. Brush resigned January 28, and Caleb Van Husan appointed to fill vacancy, and Alexander D. Fraser elected President.

1869.

Alexander D. Fraser, President.
John Owen, re-appointed May 1, for 5 years.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.

1870.

Alex. D. Fraser, President.
Jacob S. Farrand, re-appointed May 1, for 5 years.
Jno. Owen.
Caleb Van Husan.
Chauncey Hurlbut.

1871.

*Alex. D. Fraser, President.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.
John Owen.

*Term expired May 1, and Samuel F. Hodge appointed for 5 years. Jacob S. Farrand elected President.

1872.

Jacob S. Farrand, President.
Jno. Owen.
*Caleb Van Husan.
Samuel F. Hodge.
Chauncey Hurlbut.

*Term expired May 1st, and Elija Smith appointed for 5 years.

1873.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed. Elected President, May, 1872.

1874.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re.appointed.

1875.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1876.

Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. *Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1877.

Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
*Michael Martz.

*Elija Smith's term expired and Michael Martz appointed to fill vacancy.

1878.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Michael Martz.

*Term expired and re-appointed.

1879.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
*Jno. Pridgeon.

*Jno. Owen's term expired and John Pridgeon appointed to fill vacancy. Samuel F. Hodge resigned and Jas. Beatty appointed to fill vacancy.

1880.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1881.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1882.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1883.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1884.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
*Jno. Pridgeon.

*Term expired, and Marshall H. Godfrey appointed.

1885.

*Jacob S. Farrand, President. Michael Martz.
Marshall H. Godfrey. *Edwin F. Conely.
*Samuel G. Caskey.

*Jas. Beatty died and Edwin F. Conely appointed to fill vacancy.
*Chauncey Hurlbut died and Samuel G. Caskey appointed to fill vacancy.
*Jacob S. Farrand's term expired and re-appointed.

1886.

Jacob S. Farrand, President. Michael Martz.
Marshall H. Godfrey. *Jno. Pridgeon.
Samuel G. Caskey.

*Edwin F. Conely's term expired and Jno. Pridgeon appointed to fill vacancy.

1887.

Jacob S. Farrand, President. Jno. Pridgeon.
Marshall H. Godfrey. Samuel G. Caskey.
*Joseph Nagel.

*Michael Martz term expired and Joseph Nagel appointed to fill vacancy.

1888.

Jacob S. Farrand, President. Jno. Pridgeon.
Marshall H. Godfrey. *Samuel G. Caskey.
Joseph Nagel.

*Term expired and re-appointed.

1889.

Jacob S. Farrand, President. Jno. Pridgeon.
Samuel G. Caskey. Jos. Nagel.
*August Goebel.

*Marshall H. Godfrey resigned January 1, 1889. August Goebel appointed to fill lacancy. Term expired May 1st, and re-appointed.

1890.

Jno. Pridgeon, President. August Goebel.
Joseph Nagel. *Henry M. Duffield.
Samuel G. Caskey.

*Jacob S. Farrand's term expired, and Col. Duffield was appointed to fill vacancy July 9th, 1890; John Pridgeon resigned as President of the Board, on account of ill-health, and Henry M. Duffield was elected to fill vacancy.

1891.

Henry M. Duffield, President. *Jno. Pridgeon.
August Goebel. Samuel G. Caskey.
Joseph L. Hudson.

*John Pridgeon's term expired May 1st, and Frank E. Kirby was appointed for a term of 5 years.

1892.

Samuel G. Caskey, President. Henry M. Duffield.
August Goebel. Joseph L. Hudson.
Frank E. Kirby.

1893.

August Goebel, President. Samuel G. Caskey.
Frank E. Kirby. Henry M. Duffield.
Joseph L. Hudson.

1894.

Henry M. Duffield, President. Frank E. Kirby.
Albert L. Stephens. De Witt H. Moreland.
Edward W. Pendleton.

A. L. Stephens appointed to succeed J. L. Hudson.
D. W. H. Moreland appointed to succeed S. G. Caskey.
Clarence A. Black appointed to succeed August Goebel.
C. A. Black resigned and E. W. Pendleton appointed to succeed him from Dec, 1.

1895.

Frank E. Kirby, President. Albert L. Stephens.
DeWitt H. Moreland. Edward W. Pendleton.
Darius D. Thorp.

1896.

Albert L. Stephens, President.
Edward W. Pendleton.
John P. Huckestein.
Darius D. Thorp.
John W. McGrath.

D. W. H. Moreland resigned to accept Commissionership on Board of Public Works, and J. P. Huckestein was appointed to fill vacancy.

Frank E. Kirby's term expired and J. W. McGrath was appointed to succeed him.

1897.

Edward W. Pendleton, President.
Darius D. Thorp.
James W. Millen.
John W. McGrath.
August Goebel.

August Goebel, appointed to succeed A. L. Stephens. Resigned January 1, 1898, and Joseph J. Noeker was appointed to fill vacancy.

John P. Huckestein resigned and James W. Millen was appointed to fill vacancy.

1898.

Edward W. Pendleton, President.
Joseph J. Noeker.
John W. McGrath.
Darius D. Thorp.
James Meathe.

FORTY-SIXTH

ANNUAL REPORT

OF THE

BOARD OF WATER COMMISSIONERS

WATER WORKS

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR

1897.

FORTY-SIXTH ANNUAL REPORT

OF THE

BOARD OF WATER COMMISSIONERS

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1897.

DETROIT FREE PRESS PRINTING COMPANY.
1898.

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THE BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

METER RATES.

	MONTHLY
First 15,000 gals	5 cts. per M.
All over 15.000 gals	1¼ “ “
Minimum Rate	75 cts.

Payable Quarterly.

ASSESSMENT RATES.

FROM JANUARY 1st, 1898.

	PER ANNUM
For Family, household purposes	$2 00
Additional Families to first, in same house supplied with one faucet, each	1 00
Green Houses.—Special rates.	
Private Stable, for each horse	1 00
Livery Stables, “ “ “	1 00
Dray and Team Horses, each	50
Cows, each	50
Stores and Offices, from	$1 25 to 12 00
Bakeries, average daily use for each barrel of flour	2 00
Saloons, Groceries and Provision Stores, from	$2 00 to 50 00
Bar, with faucet, from	6 00 to 50 00
Fish Houses	6 00 to 50 00
Slaughter Houses.—Special rates.	
Hotels and Taverns, in addition to family rate, each room	50
Boarding Schools, from	$3 00 to 50 00
Building Purposes, each 1 M brick	02
“ “ “ 100 yards plastering	05
“ “ “ perch stone	00½
“ “ “ minimum	50
Printing Offices.—Special rates.	
Butcher Stalls, each not less than	2 00
Workshops, for 10 persons or under	2 00
“ for each additional 10 persons	1 00
Estimated quantities of water each 1,000 gallons	05
Boarding Houses, in addition to family rate, each boarder or roomer,	60

FIXTURES.

Bath Tub, for families, 1st tub	$1 00
“ “ each additional tub	60
“ “ public, each tub	4 00
Automatic Water Closets, for a family, 1st closet	1 60
“ “ “ each additional	60
“ “ “ for hotels, stores, factories, etc., for 10 persons	2 00
“ “ “ each additional person	20
Rod Water Closets, not less than	6 00
Urinals, not less than	2 00
Wash Hand Basins, for family	50 cts. to 2 00
“ “ “ for other purposes, each person	15
Hose, premises 30 feet front or less	60
“ “ 30 feet to 60 feet	80
“ “ 60 feet to 100 feet	1 60
Special Rates for larger grounds.	
Fountains	$5 00 to 20 00
Street Sprinklers, each wagon	50 00

Where there is a waste of water a proper increase of rates will be made.

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT FOR 1898.

MEMBERS:

JAMES MEATHE, 1898.
DARIUS D. THORP, 1900.
EDWARD W. PENDLETON, 1899.
JOHN W. McGRATH, 1901.
JOSEPH J. NOEKER, 1902.

COMMITTEES:

Ways and Means	Commissioners THORP, MEATHE.
Extension and Construction	Commissioners McGRATH, THORP.
Pumping Works	Commissioners NOEKER, McGRATH.
Supplies	Commissioners MEATHE, THORP.

The President is ex-officio member of each committee.

OFFICERS:

President	E. W. PENDLETON.
Vice-President	JOHN W. McGRATH.
General Superintendent	L. N. CASE.
Secretary	H. S. STARKEY.
Civil Engineer	G. S. WILLIAMS.
Supt. of Meters and Inspection	THOMAS R. PUTNAM.
Chief Engineer at Pumping Works	URIAH GOULD.
Meter Clerk	FRED. H. HUTAFF.
Assessors and Collectors	J. A. M MORETON. W. W. WILCOX. JOHN J. ROBINSON. PETER J. BECKER. THOS. W. GOODALE. ANTHONY VOGEL. CHARLES J. PATERSON. GEORGE A. WINSLOW.
Receiving Clerk	GEORGE E. KUNZE.
Permit Clerk	JOHN E. LONG.
Bookkeeper	ARTHUR J. POTTER.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

WATER COMMISSIONERS' OFFICE,
DETROIT, January 3, 1898.

To the Common Council of the City of Detroit:

Gentlemen:—The Board of Water Commissioners of the City of Detroit respectfully submits herewith its annual report for the year ending December 31st, 1897.

The General Superintendent and heads of departments have prepared detailed reports of the work under their immediate supervision, to which your careful attention is especially directed. We take pleasure, upon this occasion, in commending the various executive officers and their assistants for their faithful and efficient service, sometimes under trying circumstances on account of the considerable reduction in the number of employes. It is expected that the Board will constantly and consistently keep in view the high standard of economy and efficiency which has recently been inaugurated. Retreat is cut off; we have "burned our bridges."

During the past year, taking effect July first, 1897, and January first, 1898, the water rates have been reduced one-half. The advantage of this to the City of Detroit can only be appreciated when we realize that prior to this reduction the rates were lower than any other city in the country and, so far as known, in the world. Recent extensive improvements and additions have placed the plant in excellent condition for supply and service, but reckless extravagance in the waste of water would soon render our present facilities inadequate. A considerable saving in expenditure is anticipated from the payment for new pipe by abutting property, as provided by act of the last Legislature.

The outlay for permanent improvements during the past year, including pipe extension, has been the sum of $95,000.

The indebtedness of the Board is now $1,033,000, with annual interest of $64,320.

During the past year $100,000 of bonds have been presented and cancelled. The bonds outstanding mature as follows:

September 1st, 1899	$100,000
February 1st, 1900	100,000
August 1st, 1902	50,000
August 1st, 1903	50,000
February 1st, 1904	41,000
August 1st, 1904	244,000
June 1st, 1905	149,000
June 1st, 1906	199,000
January 10th, 1925	100,000

The total sum expended during the year is $424,230.31; the receipts $443,892.18.

The Board of Health, after careful analysis, reports that the water supply is free from any unwholesome contamination. While we are thankful that no dreaded bacilli have been found in the water, we are confronted by an insidious enemy in the shape of electrolysis. Careful watch is kept upon the scientific investigations pursuing in other cities, and it is hoped that a complete remedy may be devised before the threatened damage to water mains has become serious. It will be seen from the Superintendent's report that the means already adopted have met with considerable success.

The Board is doing its best to prevent the necessity of tearing up new pavements. Pipes are laid and all necessary connections attached before paving.

Attention has been called to the capacity of pipes for the requirements of the Fire Department. Previous to 1891, the minimum size of pipe was four inches, which then amounted to about forty-six per cent of the entire system. Since 1891, considerable four-inch pipe has been replaced by pipe of larger size, and in other localities reinforced by parallel or cross lines. The minimum size now laid is six inches, and the percentage of four-inch pipe has been reduced from forty-six to thirty. Although the Board has believed that the supply of water was adequate for any emergency, the engineer has been instructed to confer with the Fire Department and report if any enlargement of supply is required.

Suitable accommodations will soon be completed for the Hurlbut Library, and the additions thereto, as contemplated by the beneficent bequest of Mr. Hurlbut.

A resolution was recently adopted by this Board recommending that all water rates charged against the City of Detroit, including rates charged to the City Hall, Municipal Building, House of Correction, Board of Health, the Fire, Police, Park and Public Lighting Commissions, and all other municipal boards or buildings, as well as the rates charged to the Board of Education, be estimated by the Superintendent of the Board of Water Commissioners and the amount thereof be furnished to the Controller; said resolution recommending that the gross amount thereof should be placed in the general budget, collected as other city taxes and paid over to this

Board. We respectfully ask the favorable consideration of this recommendation, excepting as to the House of Correction.

Trusting that this department of the municipal government may contribute its full share to the prosperity and welfare of the city, we submit herewith an account of our stewardship.

Dated Detroit, January 3d, 1898.

EDWARD W. PENDLETON.
JAMES MILLEN.
DARIUS D. THORP.
JOHN W. McGRATH.
JOS. J. NOEKER.

REPORT OF THE SECRETARY.

Detroit, January 2, 1898.

To the Board of Water Commissioners of the City of Detroit:

Gentlemen—I have the honor to submit the Secretary's Report for the year ending December 31, 1897.

The following is a detailed statement of the receipts and disbursements:

Receipts.

Water Rates Account.—	
Rates paid	$335,997 28
Percentage Account.—	
From delinquents	6,479 27
Penalties for shutting off	363 50
Plumbers' License Account.—	
Paid for licenses	598 65
Service Connection Account.—	
Labor and materials	143 91
Service connections	4,723 50
City of Detroit Account.—	
Tax levy	74,831 01
Repairing Leaks Account.—	
Labor	103 57
Office Account	
Use of telephone	4 50
Iron Pipe Account.—	
Labor and materials	7,258 35
Bonus paid for extensions	331 90
Hurlbut Fund Account.—	
Payments from trustees	4,900 00
Rebate	2 00
Real Estate Account.—	
Rentals	2,350 00

Meter Account.—		
Sale of materials	$ 166	38
Meter repairs	31	00
Interest Account.—		
On deposits, general account	2,106	23
On deposits, sinking fund	190	40
Horse and Wagon Account.—		
Sale of horses, vehicles, etc	352	00
Pumping Works Account.—		
Sale of materials	100	00
Pumping Water Account.—		
Sale of materials	19	10
Service Extension Account.—		
Service extensions	2,789	83
Horse Expense Account.—		
Horse expenses	49	80
Total receipts	$443,892	18

Expenditures.

FOR CONSTRUCTION.

Iron Pipe Account.—		
Superintendent and clerks	$ 13.402	61
Labor	43,082	07
Iron pipe	8.689	71
Special castings	1,850	45
Lead	46	67
Valves	949	46
Tools and repairing of	464	13
Lumber	235	79
Coal	126	59
Oil	47	14
Repaving	2,791	05
Horse expense	1,741	38
Cement, sand and brick	976	95
Gate boxes and wells	1,168	28
Wagon and harness supplies and repairs	500	25
Packing and waste	109	11
Paint, etc.	80	06
Street car and toll tickets	226	55
Farrier	273	82
Medical services	77	00
Injuries	49	90

Materials	$935 77	
Veterinary services	63 00	
Freight and telegrams	5 02	
Repairing	12 65	
Hauling pipe	192 70	
Lanterns, globes, etc.	33 86	
Stationery, books, etc.	185 25	
Extra services	140 30	
Livery	3 00	
Crushed stone	20 00	
Royalty for use of testing machine	300 00	
Stop boxes	147 00	
Advertising laying of pipe	479 57	
		$ 79,260 09
Pumping Works Account.—		
Labor	$ 2,008 62	
Material—pipe, fittings, stationery, etc.	836 78	
Testing	2,719 90	
Light	718 49	
Roof	749 07	
Cable	462 07	
Draining	100 00	
Coal conveyor	500 00	
Services	248 29	
Freight	30 86	
Inspection	12 00	
Plans	375 00	
Tank	57 50	
Iron partition	49 00	
Remodeling engine	6,000 00	
		$ 14,867 58
Meter Account.—		
Superintendent and labor	$ 6,078 78	
Meters	7,955 97	
Specials and fittings	303 78	
Horseshoeing	40 50	
Harness repairs	5 70	
Materials—brass, solder, lumber, etc.	249 30	
Freight	53 90	
Street car tickets	14 00	
Repairing tools	4 60	
Printing, stationery and postage	59 60	
Horse expense	278 80	
Meter wells	235 00	
Bicycle repairs	23 30	
Meter repairs	14 13	
Meter frames	38 19	
		$ 15,355 55

Real Estate—Revenue and Expense Account.—		
Insurance	$ 468 42	
Relaying walk	15 10	
Painting building	187 00	
Repairing roof, cornices, etc	36 50	
Hitching posts	6 35	
Materials—lumber, etc.	16 00	
		$ 729 37
Engineering Account.—		
Civil engineer and assistants	$ 11,341 87	
Instruments	835 91	
Tracing cloth, etc	160 20	
Books, maps, stationery, etc	148 97	
Sundries	166 05	
Street car tickets	79 00	
Boat	68 28	
Bicycle	40 00	
Express and freight	18 02	
		$ 12,858 30
Horse and Wagon Account.—		
Horses	90 00	
Sundries	13 58	
		$ 103 58
Office Furniture and Fixtures Account.—		
Furniture and fixtures	$ 37 45	
		$ 37 45
Total construction expenses		$123,211 92

OPERATION AND MAINTENANCE.

Office Account.—	
Superintendent, secretary, assessors and clerks	$ 27,794 88
Watchman and janitors	1,900 55
Printing and binding	1,203 14
Fuel	2 31
Light repairs	19 22
Postage and telegrams	262 90
Legal services	941 00
Extra services	1,169 78
Stationery, etc.	141 69
Telephones	747 21
Veterinary services	8 00
Furniture and fixtures	83 58
Harness and buggy supplies and repairs	45 80
Farrier	26 50

Advertisements and subscriptions	$135 68	
Disinfectants	7 00	
Supplies—soap, matches, brooms, etc.	117 24	
Photographs and frames	25 23	
Express	75	
Sprinkling	75 00	
Ice	30 04	
Livery	15 50	
Auxiliary fire alarms	20 00	
Street car tickets	33 00	
Floral tributes	25 00	
Entertainment Scientists' convention	132 25	
Safe rental	10 00	
Expenses to Lansing, Commissioner and Gen'l Supt.	43 60	
Badges	50 00	
Premium on guaranty bonds	249 00	
Horse expense	139 40	
Counterfeit money	2 00	
		$ 35,457 25
Pumping Water Account.—		
Engineers and firemen	$ 19,603 30	
Engine oil and waste	433 24	
Boiler and machine repairs	248 04	
Coal	18,672 77	
Fuel oil	5 75	
Unloading coal	3,309 65	
Supplies—soap, polish, brooms, etc.	75 76	
Electric light supplies, etc.	69 42	
Street car tickets	10 00	
Ice	12 55	
Farrier	6 00	
Boiler inspection	24 00	
Stationery	1 70	
Boiler insurance	290 00	
Freight	52	
Harness repairs	1 35	
Furniture	12 00	
Horse expense	139 40	
Valves, gaskets, packing, etc.	151 09	
		$ 43,066 54
Percentage Account.—		
Labor	$ 2,480 00	
		$ 2,480 00

Repairing Leaks Account.—		
Labor	$ 13,778 00	
Horse expense	836 40	
Farrier	144 30	
Wagon and harness repairs	108 82	
Tools and materials	77 05	
Repairing tools	71 78	
Street car and toll tickets	32 00	
Oil, lead, etc.	61 35	
Repairing pavements	62 24	
		$ 15,171 94
Service Connections Account.—		
Labor	$ 7,684 26	
Cocks and valves	1,120 72	
Wagon and harness repairs	64 95	
Farrier	50 00	
Toll tickets	3 00	
Materials and repairs	89 31	
Printing	24 75	
Horse expense	278 80	
Damages	4 67	
		$ 9,320 46
Inspection Account.—		
Labor	$ 5,368 00	
		$ 5,368 00
Meter Repairs and Expense Account.—		
Fittings, etc.	$ 1,447 68	
		$ 1,447 68
Total operating expenses		$112,311 87
Bonded Indebtedness Account.—		
Bonds paid	$100,000 00	
		$100,000 00
Interest Account.—		
Interest paid	$ 79,671 52	
		$ 79,671 52
Hurlbut Fund Account.—		
Superintendent and labor	$ 4,798 61	
Tools, materials and repairs	173 46	
Repairing gate	45 00	
Car tickets	10 00	
Farrier	9 40	
Horse expense	139 40	
Library—bookcases, books and papers	304 52	
Plants, trees and flowers	232 45	
Freight and cartage	21 12	
		$ 5,733 96

Service Extension Account.—		
Labor	$ 1,109 13	
Inspection	114 25	
Lead pipe, stop boxes, curb boxes and solder	967 34	
Service cocks	108 12	
Permits	987 00	
Repairs	50	
		$ 3,286 34
Water Rates.—		
Rates refunded	$ 14 70	
		$ 14 70

RECAPITULATION.

Construction expenditures	$123,211 92
Operation and maintenance expenditures	112,311 87
Bonded indebtedness	100,000 00
Interest	79,671 52
Hurlbut Fund	5,733 96
Service extensions	3,286 34
Water rates refunded	14 70
	$424,230 31

Actual Expenses for 1897.

The expenditures of the Board, less the credits by cash received for the several accounts, are as follows:

Iron Pipe Account	$ 79,260 09	
Less receipts	7,590 25	$ 71,669 84
Pumping Works Account	14,867 58	
Less receipts	100 00	14,767 58
Meter Account	15,355 55	
Less receipts	166 38	15,189 17
Engineering Account	12,858 30	12,858 30
Office Furniture and Fixtures Account	37 45	37 45
Office Account	35,457 25	
Less receipts	4 50	35,452 75
Pumping Water Account	43,066 54	
Less receipts	19 10	43,047 44
Repairing Leaks Account	15,171 94	
Less receipts	103 57	15,068 37

Service Connections Account		$9,320 46	
Less receipts		5,466 06	$ 3,854 40
Inspection Account		5,368 00	5,368 00
Meter Repairs and Expense Account		1,447 68	
Less receipts		31 00	1,416 68
Bonded Indebted Account		100,000 00	100,000 00
Interest Account		79,671 52	
Less receipts		2,296 63	77,374 89
Hurlbut Fund Account		5,733 96	
Less receipts		4,902 00	831 96
Service Extension Account		3,286 34	
Less receipts		2,789 83	496 51
Water Rates Account		14 70	14 70
			$397,448 04
Percentage Account.—			
Receipts	$6,842 77		
Disbursements	2,480 00	$ 4,362 77	
Real Estate Account.—			
Receipts	2,350 00		
Disbursements	729 37	1,620 63	
Horse and Wagon Account.—			
Receipts	352 00		
Expenditures	103 58	248 42	
			6,231 82
			$391,216 22

The total receipts of the Receiving Clerk from January 1, 1897, to January 1, 1898, were as follows:

January	$ 61,251 03	
February	16,997 71	
March	22,773 48	
April	57,445 17	
May	15,629 05	
June	23,126 27	
July	72,245 15	
August	63,636 89	
September	22,912 76	
October	50,171 62	
November	15,146 86	
December	22,556 19	
	$443,892 18	
Cash on hand January 1, 1897	5,985 76	
		$449,877 94

With bank deposits as follows:

January	$ 57,296 36	
February	24,691 38	
March	18,975 90	
April	53,764 02	
May	23,184 35	
June	19,455 31	
July	67,392 68	
August	71,802 78	
September	20,133 91	
October	47,146 79	
November	21,624 15	
December	20,237 71	
	$445,705 34	
Cash on hand January 1, 1898	4,172 60	
		$449,877 94

Cash Statement, Year 1897.

January 1, 1897.	Dr.	
Cash on hand	$ 5,985 76	
Commercial National Bank—		
Balance General Fund	36,771 54	
Commercial National Bank—		
Balance General Supt. Fund	1,000 00	
Receipts, 1897	443,892 18	
		$487,649 48
January 1, 1898	Cr.	
Cash on hand		$ 4,172 60
Am. Ex. Natl. Bank—		
Balance General Fund	$ 61,888 36	
Checks outstanding	3,641 79	
		58,246 57
Am. Ex. National Bank—		
Balance Gen. Supt. Fund		1,000 00
Disbursements		424,230 31
		$487,649 48

THE AMERICAN EXCHANGE NATIONAL BANK,

DETROIT, January 3, 1898.

H. S. STARKEY, *Secretary Board of Water Commissioners, Detroit, Mich.*:

DEAR SIR—This is to certify that the amount of your balance in this bank at the close of business December 31, 1897, was $61,888.36.

Yours respectfully,

HAMILTON DEY,
Cashier.

Water Rates.

The following table is the report of the assessment made in May and June, to commence July 1, 1897:

ASSESSMENT 1897-98.

Dist.	WARDS.	FAMILIES.			Increase.	Vacant Tenements.	ASSESSMENT.		
		Supplied.	Not Supplied.	Whole Number.			1897-98.	Decrease.	Transf'rd to Meter Rolls.
1	Ninth.......	5,496	12	5,508	52	91	$17,194 00	$5,722 00	$233
	Fifteenth...	1,687	3	1,690	187	49	6,501 75	4,253 25	320
	Seventeenth	1,669	45	1,714		65	6,552 00		430
	Totals ...	8,852	60	8,912	239	205	30,247 75	9,975 25	983
2	Eleventh ...	3,718	6	3,724	38	112	12,851 50	4,291 50	289
	Thirteenth..	2,724	14	2,738	60	101	9,779 55	3,105 45	365
	Totals ...	6,442	20	6,462	98	213	22,631 05	7,396 95	654
3	First........	2,767	4	2,771	93	85	15,748 85	6,890 15	1,337
	Seventh	3,445	14	3,459	39	131	11,022 00	3,678 00	177
	Totals....	6,212	18	6,230	132	216	26,770 85	10,568 15	1,514
4	Third.......	3,351	8	3,359	49	103	11,649 85	4,336 15	568
	Fifth........	3,954	6	3,960	74	88	13,082 95	4,496 05	439
	Totals ...	7,305	14	7,319	123	191	24,732 80	8,832 20	1,007
5	Second	2,197	6	2,203	51	116	18,850 50	4,249 50	1,045
	Sixth........	3,719	8	3,727	6	166	15,366 95	6,613 05	1,057
	Totals ...	5,916	14	5,930	57	282	34,217 45	10,862 55	2,102
6	Tenth.......	4,297	12	4,309	24	144	15,948 85	6,081 15	673
	Fourteenth.	2,525	19	2,544	65	67	9,154 15	3,010 85	254
	Totals ...	6,822	31	6,853	89	211	25,103 00	9,092 00	927
7	Fourth......	3,262	6	3,268	116	140	15,937 90	6,693 10	1,059
	Twelfth	3.439	2	3,441	63	140	12,264 40	4,203 60	458
	Totals ...	6,701	8	6,709	179	280	28,202 30	10,896 70	1,512
8	Eighth......	3,606	3	3,609	37	142	14,301 25	6,009 75	1,219
	Sixteenth...	3,089	202	3,291	60	85	10,673 60	3,218 40	439
	Totals ...	6,695	205	6,900	97	227	24,974 85	9,228 15	1,658
	Aggregate	54,945	370	55,315	1,014	1,825	$216,880 05	$76.851 95	$10,357

As shown in this table, July 1, 1897, there were 55,315 families in the City of Detroit. Using the same average per family as in previous years, 5.14, the population of the city at that time was 284,319, an increase over July 1, 1896, of 5,212.

The average used was obtained by taking the population as shown by the United States Census of 1860-70-80 and 90, and dividing by the number of families on Assessors' books for those years, as follows:

Years.	Population per census.	No. of familes assessed.	Average.
1860	45,619	8,973	5.08
1870	79,757	14,717	5.42
1880	116,340	22,423	5.18
1890	205,876	42,059	4.89

Making the general average 5.14.

July 1 the assessment rates were reduced about 25 per cent, which was followed in December by a further reduction of about the same amount, to take effect January 1, 1898.

The decrease in the assessments, as compared with that of 1896-7, was $76,851.95, of which $10,357 was by transfer to the meter rolls, leaving a decrease to the benefit of the rate payers of $66,494.

The following table shows the receipts for water rates during the year, arranged by districts, and giving the amounts collected upon each annual assessment:

RECEIPTS OF WATER RATES BY DISTRICTS.

YEAR.	1st District Wards 9 and 15.	2d District, Wards 11 and 13.	3d District, Wards 1 and 7.	4th District, Wards 3 and 5.	5th District, Wards 2 and 6.	6th District, Wards 10 and 14.	7th District, Wards 4 and 12.	8th District, Wards 8 and 16.	Meters, Jan. 1, 1897, to Jan. 1, 1898.	Aggregate.
1885-6	....	....	....	$1 25	....	....	....	....	....	$1 25
1888-9	....	....	....	1 25	....	....	....	....	....	1 25
1889-90	....	....	....	3 00	....	....	....	....	....	3 00
1890-1	....	....	....	3 00	$2 75	....	....	....	....	5 75
1892-3	....	....	$1 25	....	....	....	....	....	....	1 25
1893-4	$5 00	$8 05	6 50	13 50	6 00	$1 25	$6 50	$19 50	....	66 30
1894-5	35 75	12 50	30 00	1 25	....	15 75	3 75	26 00	....	125 00
1895-6	46 75	50 50	72 25	26 50	111 00	116 00	31 75	50 89	....	505 64
1896-7	19,960 92	15,667 82	18,441 77	16,676 07	22,577 50	17,272 24	19,514 01	18,233 08	....	148,343 41
1897-8	15,607 58	11,422 79	13,445 74	12,305 10	15,135 26	12,383 45	13,850 74	12,693 08	$80,100 68	186,944 43
Total..	$35,656 00	$27,161 66	$31,997 51	$29,030 92	$37,832 51	$29,788 69	$33,406 75	$31,022 56	$80,100 68	$335,997 28

Water Works Bonds.

The following table shows the whole history of the bonded indebtedness of the Board, in which it will be seen that the total amount of bonds issued is $1,950,000, of which $917,000 have been redeemed, leaving outstanding $1,033,000. During the year $100,000 of bonds were redeemed.

No. of Issue.	Act of	Issued.	Payable.	Amount.	Rate of Interest.	Redeemed.	Outstanding.
1st	1853	Aug. 1, 1853	Aug. 1, 1883	$100,000	7cts.	$100,000	....
"	"	" "	Aug. 1, 1878	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1873	50,000	7 "	50,000	....
2nd	1855	Aug. 1, 1855	Aug. 1, 1890	100,000	7 "	100,000	....
"	"	June 12, 1855	Aug. 1, 1885	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1880	50,000	7 "	50,000	....
3rd	1857	Aug. 1, 1858	Aug. 1, 1893	150,000	7 "	150,000	....
"	"	Aug. 1, 1867	Aug. 1, 1887	100,000	7 "	100,000	....
4th	1869	Feb. 1, 1870	Feb. 1, 1900	100,000	7 "	....	100,000
5th	"	Aug. 1, 1872	Aug. 1, 1902	50,000	7 "	....	50,000
6th	"	Aug. 1, 1873	Aug. 1, 1903	50,000	7 "	....	50,000
"	1873	Feb. 1, 1874	Feb. 1, 1904	50,000	7 "	9,000	41,000
7th	1869	Aug. 1, 1874	Aug. 1, 1904	50,000	7 "	6,000	44,000
"	1873	" "	" "	200,000	7 "	....	200,000
"	"	June 1, 1875	June 1, 1905	150,000	7 "	1,000	149,000
"	"	June 1, 1876	June 1, 1906	200,000	6 "	1,000	199,000
"	"	Sept. 1, 1880	Sept. 1, 1899	100,000	4 "	....	100,000
"	"	April 1, 1881	April 1, 1897	100,000	4 "	100,000	....
"	"	Dec. 1, 1881	Dec. 1, 1896	50,000	4 "	50,000	....
"	"	Jan. 10, 1895	Jan. 10, 1925	100,000	4 "	....	100,000
				$1,950,000		$917,000	$1,033,000

The amount expended for the Pumping Works to January 1, 1898, is as follows:

ITEMS.	Previously Expended.	1897.	Total.
Land	$38,331 44	....	$38,331 44
Force Mains	624,058 03	....	624,058 03
Inlet Pipe	90,811 84	....	90,811 84
Dock, Basin and Canal	148,291 60	....	148,291 60
Conduits and Wells	81,461 70	....	81,461 70
Engine, Boiler and Coal Houses	215,124 62	$1,817 64	216,942 26
Stand Pipe and Tower	31,574 16	....	31,574 16
Pump Wells	54,221 56	....	54,221 56
Engines	350,860 62	6,000 00	356,860 62
Boilers	74,049 76	2,719 90	76,769 66
Engineer's House	8,139 75	....	8,139 75
Sewers	3,666 25	....	3,666 25
Electric Light Plant	....	718 49	718 49
Grounds, Fences and Gateway	129,438 44	9,302 65	138,741 09
Inspection	2,977 86	12 00	2,989 86
Miscellaneous	14,295 67	30 86	14,326 53
Totals	$1,867,303 30	$20,601 54	$1,887,904 84

All of which is respectfully submitted.

H. S. STARKEY,
Secretary.

REPORT

OF THE

GENERAL SUPERINTENDENT.

January 2d, 1898.

To the Board of Water Commissioners:

Gentlemen—In accordance with the regulations of your honorable body, I have the honor to submit the following report of the general operation and construction of the Works for the year 1897:

Pumping Works.

Hardly any construction has been entered upon the past year at the Works, with the exception of the contract with the Frontier Iron Works for certain alterations in engine No. 3, and the commencement of the work of constructing a library and boat house at the north end of the canal.

The alterations spoken of are the same, practically, as those made on engine No. 2 in 1894, and, as stated in my report for that year, are the results of the thought and study of Engineer Gould. These alterations permit the pumps to be used as single and double acting. When used as the former, the pistons simply use their force on the downward stroke, and therefore discharge but about one-half the water of their ordinary capacities, and requiring, therefore, but one-half the steam. A 24,000,000-

gallon engine is thus reduced to a 12,000,000-gallon engine in five minutes, or vice versa.

The history of the use of fuel at the Works, the various kinds used and the results obtained pecuniarily are of considerable interest.

Hard coal was in use for many years, as it was thought no other fuel could be used because of the close proximity of the settling basin. In 1892 the use of crude oil was introduced, and a plant established for this purpose, which was the cause of considerable saving as long as the price of oil remained in the neighborhood of 1.50 cents per gallon.

In the fall of 1895, however, the price had gone up to 2.18 cents, when the Board determined to abandon it for the use of soft coal, with attachments to the furnaces for the prevention of smoke.

In the meantime, tests were made of so-called "smokeless" coals, which were found so near that condition that they could be used without any material injury to the water in the basin.

The results of the operations of the Board in the use of fuel can best be shown in the following tables; the first giving annual results for the past eleven years, and the second the results by months of the year 1897:

FUEL CONSUMED AT PUMPING WORKS.

YEARS.	GALLONS PUMPED.	FUEL.		COST PER MILLION GALLONS.	REMARKS.
		KIND.	COST.		
1887....	13,168,895,808	Hard coal.......	$35,773 05	$2 71⅔	Cost of coal..$4 40
1888....	14,380,166,670	Hard coal.......	39,341 81	2 73½	Cost of coal.. 4 47
1889 ..	12,875,334,453	Hard coal.......	34,314 27	2 68⅛	About 800 tons of coke used. Cost of coal......... 4 50
1890....	12,120,944,532	Hard coal.......	31,763 40	2 62	Cost of coal 4 17
1891....	12,057,261,236	Hard coal. Natural gas ...	33,734 77	2 79	
1892....	12,276,612,482	Hard coal. Natural gas ... Crude oil.	31,031 00	2 52⅘	Pressure increased about 7%. Oil at.............. 1 50
1893....	13,877,977,208	Crude oil........	27,479 93	1 98	Pressure increased about 7%. Oil at.............. 1 52½
1894....	13,649,779,605	Crude oil........	29,283 47	2 14½	Pressure increased about 5⅜%. Oil at.............. 1 55
1895....	14,698,451,954	Crude oil........	32,095 14	2 18⅛	Pressure increased about 8%. Oil at......1 55 and 2 18
1896....	13,254,369,371	Crude oil. Hard coal. Smokeless coal	31,186 17	2 35¼	Pressure increased about 4¼%. Oil at............ . 2 18 Hard coal.......... 4 37 Smokeless coal...... 2 60
1897....	12,928,821,326	Smokeless coal..	17,355 58	1 39⅜	Smokeless coal...........................2 60 and 2 40

FUEL AT PUMPING WORKS, 1897.

MONTHS.	GALLONS OF WATER PUMPED.	COAL CONSUMED.		COST PER MILLION GALLONS.	HEAD PUMPED AGAINST.	PER CENT. OF WATER BY NO. 4 ENGINE.
		POUNDS.	COST.			
January	1,149,932,994	1,217,500	$1,582 75	$1.376+	46.75 lbs.	37 4+
February	1,017,585,300	948,138	1,232 58	1.211+	46.94 "	45.5+
March	1,050,514,658	1,029,172	1,337 93	1.273+	46.39 "	48.8—
April	933,189,334	847,148	1,101 29	1.18	45.58 "	48.
May	980,886,532	871,902	1,141 65	1.163	46.24 "	46.4
June	1,055,763,432	1,158,090	1,407 84	1 333	47.07 "	....
July	1,316,366,940	1,391,520	1,798 67	1.358	48 67 "	....
August	1,155,358,116	1,253,256	1,629 23	1.41	47 65 "	....
September	1,163,350,920	1,301,203	1,691 56	1.454	48.14 "	....
October	1,111,183,332	1,222,022	1,588 62	1 42	47.60 "	....
November	945,753,048	1,060,394	1,378 51	1.457	46.56 "	47.3
December	1,048,936,720	1,141,998	1,464 95	1.396	46.68 "	46.9
Totals	12,928,821,326	13,442,343	$17,355 58	Average, $1.342	Mean, 47.09 lbs.	

The following table is also of interest, as showing the gradual decrease in the total cost of pumping water by the introduction of different fuels and other economical methods by the Board:

YEARS.	Supplied Population.	Gallons Pumped.	Cost of Pumping.	Cost per Person.
1887.............	177,258	13,168,859,808	$57,852 00	32$\frac{1}{3}$ cts.
1888.............	189,475	14,380,166,670	60,284 11	31$\frac{4}{5}$ cts.
1889.............	201,272	12,875,334,453	61,560 48	30$\frac{1}{2}$ cts.
1890.............	213,140	12,120,944,532	54,433 49	25$\frac{1}{2}$ cts.
1891.............	225,815	12,057,261,236	53,012 77	23$\frac{4}{9}$ cts.
1892.............	238,496	12,276,612,482	53,287 39	22$\frac{1}{3}$ cts.
1893.............	256,059	13,877,977,208	46,546 01	18$\frac{1}{7}$ cts.
1894.............	256,547	13,649,779,605	48,146 11	18$\frac{3}{4}$ cts.
1895.............	264,329	14,698,451,954	51,772 07	19$\frac{3}{5}$ cts.
1896.............	277,256	13,254,369,371	53,234 42	19$\frac{1}{5}$ cts.
1897.............	281,417	12,928,821,326	38,123 99	13$\frac{1}{2}$ cts.

As outlined in last year's report, tests were made of the Hawley Down Draft Furnace and the Murphy Stoker by George H. Barrus, of Boston. The report of Mr. Barrus, after the completion of the tests, was accepted by the Board, and the report ordered printed in the Annual Report of the Board. The complete report of Mr. Barrus will be found at the conclusion of this volume.

The Water.

In my report for 1895, I said, in view of certain discussions regarding the purity of the water: "The Board of Water Commissioners has never received any information from the Board of Health, directly or indirectly, that the waters of Detroit River contain germs, either organic or inorganic, that are periling the public health."

The Board of Health is making monthly chemical and bacteriological analyses of the water, and inasmuch as it

is a question of so much importance to the public, I submit herewith the following extract from the report of W. I. Tibbals, chemist and bacteriologist of the said Board:

The importance of a pure water supply to the public health of a community cannot be overestimated. There have been reported from various localities innumerable instances of epidemics traced to the use of a dangerous drinking water. In fact, so numerous are such cases, and so conclusive the evidence pointing to the source of trouble, that the health authorities of many of our large cities, appreciating the value of a watchful and preventive policy, have provided for frequent analysis of the public water.

During the past year I have devoted as much attention as possible to our supply; and while the time was not available for as many examinations as seem desirable, yet several have been made, the results of which, with a brief explanation, are here given:

CHEMICAL ANALYLIS.

Estimations are in parts per million.

	MONTH.			
	April.	July.	Sept.	Feb.
Appearance	Turbid.	Clear.	Sl'ly t'rbid	N'rly clear
Reaction	Neutral.	Neutral.	Neutral.	Neutral.
Total solids	124.40	110.00	115.80	114.40
Volatile and organic matter	42.00	41.20	39.20	32.00
Nonvolatile and mineral "	82.40	68.80	76.60	82.40
Free Ammonia	.066	.058	.030	.056
Albuminoid ammonia	.078	.066	.088	.084
Nitrogen as nitrates	....	....	.066	.132
Nitrogen as nitrites	....	....	.000	.000
Chlorine	2.55	2.60	2.80	2.70
Oxygen absorbed in 15 min.	.32	.34	.34	.36
Oxygen absorbed in 4 hours	.64	.62	.68	.70
Total suspended matter	11.10			
Inorganic suspended matter	10.37			
Volatile suspended matter	0.73			

BACTERIOLOGICAL AND MICROSCOPICAL.

April—	Bacillus typhi abdominalis (typhoid fever bacillus)	Absent
"	Bacillus coli communis	Absent
"	Bacteria per cubic centimeter	140
"	Microscopical—Fine sand, diatomes and algae	...
July 9, '96—	Bacteria per cubic centimeter	95
" 15, '96—	" " "	110
" 18, '96—	" " "	80
Sept. 22, '96—	" " "	200
" 23, '96—	" " "	130
" 28, '96—	" " "	80
Oct. 27, '96—	" " "	40
" 28, '96—	" " "	108
" 30, '96—	" " "	48
" 31, '96—	" " "	130
Dec. 15, '96—	" " "	120
" 16, '96—	" " "	350
" 23, '96—	" " "	85
" 24, '96—	" " "	125
" 29, '96—	" " "	180
" 30, '96—	" " "	150
Feb. 15, '97—	" " "	80
" 16, '97—	" " "	800
" 17, '97—	" " "	320
" 18, '97—	" " "	220
" 19, '97—	" " "	480
" 20, '97—	" " "	530
" 22, '97—	" " "	210

The samples were taken from the laboratory tap and subjected to the usual bacteriological examination and sanitary chemical analysis, which includes only an estimation of such substances as are of value in determining the drinking quality of the water. The estimation of the number of bacteria is self-explanatory. Good drinking water should not contain more than 1,000 bacteria in each cubic centimeter (about 16 drops). The total solids represent the entire amount of solid matter, both mineral and organic, in the sample. The volatile and organic matter is that portion of the total solids which is burned or driven off at a red heat, and consists largely of organic matter, together with some volatile mineral matter. The chlorides, albuminoid ammonia, free ammonia, oxygen absorbed, nitrates and nitrites all indicate organic matter, and in relatively large quantities point to contamination. The small amount of these substances in our water fully justifies the statement, that at present it compares most favorably with the supply of other cities, as far as freedom from sewage or other dangerous contamination is concerned.

The different analyses show remarkably little variation, except in the total solids, or more particularly, the mineral matter, an increased quantity of which corresponds with an increased turbidity of the water. The suspended matter causing this roily appearance, often noticed, especially after severe storms, consists of fine sand and clay, which, although inert, cannot be very digestible, and may cause trouble if taken in too large or too frequent doses.

Estimations are in parts per million. Samples from the Laboratory tap.

	March.	April.	May.	June.
Appearance	V'y turbid	Turbid.	Turbid.	S'ly turbid
Total solids	148.00	130.08	132.04	112.20
Volatile and organic matter	42.00	42.02	41.08	41.80
Nonvolatile and mineral "	106.00	88.06	90.06	70.40
Free ammonia	.078	.050	.032	.034
Albuminoid ammonia	.118	.076	.100	.094
Nitrogen as nitrates	.164	.247	.115	.148
Nitrogen as nitrites	none.	none.	none.	none.
Chlorine	2.75	2.45	2.70	2.60
Oxygen absorbed in 15 min.	2.20	.62	1.18	.98
Oxygen absorbed in 4 hours.	2.72	.94	1.78	1.62
Bacteria per cubic centimeter	990	60	310.	480
" " "	680	130	490	610
" " "	752	90	120	700
" " "	....	....	190	....

Economy of Waste.

HISTORICAL.

YEARS.	FAMILIES SUPPLIED.	WATER PUMPED.	
		TOTAL QUANTITY.	PER FAMILY.
1852	......	235,840,275	......
1853	4,283	303,531,743	70,868
1854	4,619	376,265,126	81,460
1855	5,282	542,807,364	102,765
1856	5,706	692,124,305	121,297
1857	6,189	697,190,523	112,650
1858	6,474	718,091,207	110,919
1859	6,794	782,112,587	115,118
1860	6,750	870,036,451	125,185
1861	7,128	895,129,423	125,579
1862	7,275	994,945,329	136,762
1863	7,699	1,035,798,043	134,534
1864	7,993	1,019,390,256	127,410
1865	8,351	1,040,514,887	125,675
1866	9,089	1,196,317,922	131,622
1867	10,242	1,425,535,230	139,186
1868	11,544	1,666,545,125	144,364
1869	12,774	1,946,810,325	152,400
1870	13,722	1,866,060,068	136,000
1871	14,896	2,300,150,605	154,414
1872	16,035	2,782,292,578	173,513
1873	17,019	3,198,393,948	187,930
1874	18,853	3,289,872,635	174,511
1875	19,606	4,207,454,260	214,600
1876	20,102	4,065,134,470	200,225
1877	20,345	4,213,239,790	207,090
1878	20,603	4,345,743,330	210,927
1879	21,341	5,129,599,110	240,348
1880	22,465	5,552,965,310	247,183
1881	23,749	6,543,127,968	279,722
1882	25,442	6,284,000,742	243,062
1883	27,415	7,379,327,788	269,170
1884	29,424	8,510,614,140	289,260
1885	30,533	9,970,829,580	326,886
1886	31,946	10,576,571,254	331,070
1887	34,486	13,168,859,808	381,860
1888	36,863	**14.380,166.670**	**390,098**
1889	39,158	12,875,334,453	328,880
1890	41,467	12,120,944,532	292,300
1891	43,933	12,057,261,236	274,470
1892	46,400	12,276,612,482	264,582
1893	49,817	13,877,977,208	278,579
1894	49,912	13,649,779,605	273,476
1895	51,426	14,698,451,954	285,818
1896	53,941	13,254,369,371	245,719
1897	54,945	12,928,821,326	235,305

In the year 1889, the Board commenced the introduction of measures for the prevention of waste. The results are best shown by the foregoing table.

The average number of gallons pumped for the year to each family supplied in 1888 was over 390,000. The daily per capita on the basis of the population was 204 gallons.

Last year the former amount was 235,000 gallons, and the latter 124½ gallons.

It will be seen, also, by the table that the total number of gallons pumped was less than in 1887, when the population was over 100,000 less than that of last year.

Electrolysis.

In my last report I gave a full description of the trouble we had had the previous year with electrolysis of the water pipes, and the steps that had been taken, in conjunction with the street car company, to prevent it.

It is gratifying to state that the measures then adopted were very successful, and that during the past year but two cases of electrolysis were brought to my attention, and those evidently of such long standing as conclusively to have been caused anterior to the adoption of the methods to prevent it.

From time to time there no doubt will occur leaks in service pipes weakened by electrolytic action in the past, but I have good reasons to believe that the cause of such action has been fully understood and the right measures adopted to prevent its recurrence.

Water Rates.

The actual reductions in the amounts collected from consumers of water are not properly shown by the difference only between the rates collected any one year and the year previous.

These reductions are correctly shown by the difference between the rates actually received and those that would have been received had the former schedule of rates still continued to prevail.

In order to establish a basis for such computation it is necessary to prove that, notwithstanding the fact that the total water rates received are for all purposes supplied, business, manufacturing and household, yet if the schedule of rates remain the same, the total amount received, divided by the number of families supplied, will give practically the same quotient.

To that end I submit the following table of ten years previous to 1886, during which years there were no changes in the rates:

YEARS.	No. of Families Supplied.	Rates Received for all Purposes.	Average per Family.	REMARKS.
1876..........	20,102	$205,624 74	$10 23	
1877..........	20,345	210,288 12	10 33	
1878..........	20,603	208,193 95	10 10	
1879..........	21,341	218,110 13	10 22	
1880..........	22,465	227,452 73	10 12	$10 21
1881..........	23,749	241,884 32	10 18	General Average.
1882..........	25,442	261,725 79	10 28	
1883..........	27,415	280,049 06	10 21	
1884..........	29,424	300,467 24	10 21	
1885..........	30,533	313,205 10	10 25	

In the year 1886 the rates for household purposes for families were reduced to a flat rate of $5 for each family. This reduction took effect July 1, 1886, and the schedule of rates so reduced prevailed without any change during the four succeeding years, under which the statement is as follows:

YEARS.	No. of Families Supplied.	Rates Received.	Average per Family.	REMARKS.
1887..........	34,486	$322,834 59	$9 36	
1888..........	36,863	344,315 26	9 34	$9 36
1889.........	39,158	367,925 27	9 39	General Average.
1890.........	41,467	387,877 73	9 35	

In 1891, and in almost every succeeding year thereafter, there have been certain reductions in the rates, which are narrated below and which have had the following effects:

YEARS.	No. of Families Supplied.	Rates Received.	Average per Family.
1891........................	43,933	$389,079 97	$8 85
1892........................	46,400	402,534 98	8 67
1893........................	49,817	420,490 83	8 44
1894........................	49,912	418,728 76	8 39
1895........................	51,426	428,772 41	8 34
1896........................	53,941	406,147 82	7 52
1897........................	54,945	335,997 28	6 09

It is estimated that the change in the rates taking effect January 1, 1898, will produce the following:

Number of families to be supplied........................	56,445
Water rates to be received...............................	$227,395
Average per family	4.02

The reductions in the schedule of rates since 1890 have been as follows:

September 1, 1890, meter rates were reduced to 3⅓ cents per 1,000 gallons for quantities exceeding 3,000 cubic feet each month. Under 3,000 cubic feet, to 6⅔ cents per 1,000 gallons.

July 1, 1891, the charge for the use of hose for lawn and street sprinkling was abated, the annual amount previously received therefrom being estimated at about $20,000. Hose tax was restored July 1, 1897.

July 1, 1894, the rates on fixtures were largely reduced.

April 1, 1896, the meter rate was reduced to 2 2/9 cents per 1,000 gallons for all over 3,000 cubic feet each month.

July 1, 1896, the rate of $5 upon families for household purposes was reduced to $4.

July 1, 1897, a 25 per cent reduction was made in the entire schedule of rates, meter and assessed.

January 1, 1898, an additional 25 per cent reduction was made.

In order to show the total reductions made in the water rates since 1890, the following table is introduced:

YEARS.	No. of Families Supplied.	Rates Received.	Rates would have received at the average of $9.36 per family.
1891	43,933	$389,079	$411,212
1892	46,400	402,534	434,304
1893	49,817	420,490	466,287
1894	49,912	418,728	467,176
1895	52,426	428,772	490,707
1896	53,941	406,147	504,887
1897	54,945	335,997	514,285
Totals		$2,801,747	$3,288,858
Total of reductions			$487,211

COMPARATIVE STATEMENT.

	1887.	1888.	1896.	1897.
Daily average consumption in gallons	36,079,068	39,397,716	36,313,340	35,421,430
Daily average consumption per capita	195	204	130	124⅛
Total annual consumption	13,168,859,808	14,388,166,670	13,254,369,871	12,928,821,326
Total consumption through meters	65,182,000	91,750,000	2,263,413,500	2,427,447,000
Revenue from unmetered water	$316,316.30	$335,140.10	$321,742 23	$256,164.17
Revenue from metered water	$6,518.20	$9,175.00	$84,405.59	$79,833 11
Per 1,000 gallons metered water	.10	.10	.037+	.033
Per 1,000 gallons unmetered water	.024	.023	.029+	.024+
Number of families supplied	34,486	36,863	53,941	54,945
Number of service connections	32,938	36,609	50,599	52,219
Miles of pipe	322	325	518	520
Number of meters	About 40	48	4,584	5,392
*Estimated population	184,829	194,996	279,107	284,319

* Population estimated by multiplying families in city by 5.14.

If 25 per cent of the water ordinarily called "unmetered" water, which, in fact, is the difference between the total quantity pumped and the quantity supplied through meters, and which is an estimate of the quantity lost in transit to consumers, together with the quantity supplied for public purposes unpaid for, the rate for "unmetered" water would be .032½, or about the same as for metered water.

Pipeage System.

The extensions to the system the past year have been made only on petitions for the supply of new territories. These amount to $10\frac{3440}{5280}$ miles, of which $2\frac{4514}{5280}$ were laid outside city limits. The Board now have $17\frac{2177}{5280}$ miles of pipe outside city limits, all of which has been paid for by the parties petitioning for such extensions.

There were discontinued during the year 5,256 feet of pipe, replaced by larger, which makes the net increase to the system but $9\frac{3464}{5280}$ miles.

The total mileage of the distribution system is $526\frac{2843}{5280}$ miles. This is shown in the following table, in the different sizes of which it is composed:

Size of Pipe in Inches.	Measured Length in Feet for 1896.	Added Length in Feet for 1897.	Discontinued Length in Feet for 1897.	Total Length in Feet for 1897.
45	103	....	....	103
42	59,491	....	....	59,491
36	715	....	....	715
30	54,494	....	....	54,494
24	84,587	....	....	84,587
20	106	....	....	106
18	87	....	....	87
16	48,068	....	....	48,068
12	23,015	4,583	3	27,595
10	143,816	4,748	9	148,555
8	293,863	2,452	17	296,298
6	1,170,460	41,749	787	1,211,422
4	781,775	2,672	4,053	780,394
3	65,739	36	387	65,388
2	2,820	....	....	2,820
Total,	2,729,139	56,240	5,256	2,780,123

It will be seen by this table that 30½ per cent of the system is composed of four-inch and lesser sizes.

Previous to the year 1891 the ordinary extensions consisted principally of four-inch pipe, and amounted at that time to 46 per cent of the entire system.

In January of that year I prepared a tabular statement of the different sizes of pipe in use in several of the larger cities in the United States and presented it to the Board, which showed Baltimore as the only one exceeding Detroit in its percentage of the smaller sizes.

A resolution was passed at that time making a six-inch the minimum size to be laid in the future. The result has been a considerable decrease in this percentage, as shown above.

In addition to this, for the purpose of providing a better supply for fire protection, parallel lines of larger mains have been laid in the central and business portions of the city, and in other localities the system reinforced by larger cross lines, upon which, to a considerable extent, the hydrants are located.

No complaints have been made of a short supply in the suppression of fires for some years, and it is generally considered by this department, as well as by the Fire Department, that, with the exception, possibly, of a few localities, the protection from fires has been comparatively well provided for.

Connected with the mains there are now in the city 3,002 hydrants and 549 reservoirs.

Since the action of the Board relieving me of the duties of Secretary, I have given more active attention to the work outside, and the results obtained, particularly in the laying of water pipe.

The character of the soil and the extent of special work required were carefully noted, and the results communicated to the foreman, with approval or disapproval, as the circumstances required.

The following table will explain these operations in detail; and, notwithstanding the fact that $1.50 was paid for a day's work of eight hours, and that the majority of the laborers were unskilled and commonly, by reason of age or physical condition, unfitted for hard work, yet the results show a considerable improvement. The average cost per foot of laying six- (6) inch mains was 57 $^{3}/_{10}$ cents.

STREET.	Length of pipe in feet.	Diameter of pipe.	Total cost per foot.	Cost of labor per foot.	NATURE OF SOIL.	Back-filled with or by.	REMARKS.
Pennsylvania Ave.	243	6 in.	$ .581	$ .22	Mostly Clay.	Water.	
Thirtieth St.	796	6 in.	.566	.182	Hard Clay.	"	
Woodland Ave.	870	6 in.	.567	.209	One-half Clay.	"	
Cameron Ave.	171	6 in.	.536	.168	Sand-Loam.	"	
Melbourne Ave.	247	6 in.	.629	.211	Clay—All.	"	
Woodland Ave.	999	6 in.	.553	.186	" "	"	
Page St.	381	6 in.	.579	.172	Loam.	"	
McKinley Ave.	348	6 in.	.515	.149	Loam and Clay.	"	
Canfield Ave.	373	6 in.	.608	.214	" " "	"	
Cadillac, N of Warren.	790	12 in.	1.05	.353	" " Sand.	"	
Burnett Ave.	591	6 in.	.526	.204	" " "	"	
Frontenac Ave.	587	6 in.	.51	.193	Loam, Sand and Clay.	"	
Helen Ave.	140	6 in.	.508	.225	" " " "	"	
Lambert.	496	6 in.	.532	.222	" " " "	"	
Ferry Ave.	592	6 in.	.521	.21	Clay.	"	
Pallister Ave.	1035	6 in.	.533	.233	" and Loam.	"	Delaney sick—work performed by Ass't Foreman.
Cadillac, N. of Mack	3705	12 in.	1.215	.37	Loam and Sand.	"	
Eldred St.	384	6 in.	.536	.219	Sand.	"	Crossing Junction Ave., 18 ft. x 14 ft., pavement removed and relaid.
King Ave.	113	6 in.	.60	.275	Hard Clay.	"	Had to carry pipe by hand about 65 feet.
Cameron Ave.	228	6 in.	578	.258	Hard Clay and Sand.	"	Ditch owing to grade, 6 ft. deep.
Boulevard	502	6 in.	.541	.24	Hard Clay.	"	
Garfield Ave	275	6 in.	.551	.218	Sand and Loam.	"	
Ellery St.	420	6 in.	.524	.218	" " "	"	
Dallas St.	598	6 in.	.565	.241	Clay and Loam.	"	Cold freezing weather.
Welch Ave.	251	6 in.	.571	.226	Sand and Red Clay.	"	
Parker Ave	606	6 in.	.54	.24	Clay and Loam.	"	Cold freezing weather.
Palmer Ave.	338	6 in.	.55⅛	.19	Clay.	"	
Delaware Ave.	563	6 in.	.70	.325	Sand and Loam.	Tamped.	Because of new paving.
Seventh St.	346	6 in.	.69	.307	" " "	Water.	Special work at connection.
Welch Ave.	158	6 in.	.67	.238	" " "	"	
Tillman Ave.	198	6 in.	.63⅛	.222	" " "	"	
Thompson Court.	106	6 in.	.71⅛	.265	Clay.	"	
Warren Ave.	527	6 in.	.609	.231	"	"	
Medbury, Alley N. of.	375	6 in.	.548	.151	Sand.	"	
			Average, .573				

At the conclusion of this report will be found in detail the location, lengths and sizes and extensions made the previous year. The action of the Board, relieving the former Superintendent of the Department of Extension and Construction from duty, and placing the same under my immediate supervision, is the reason of this general report containing the operations of this department.

Valves.

The number of valves or gates in the system now amount to 6,314, and are as follows:

GATES IN SYSTEM TO JANUARY 1st, 1898.

	42-In.	36-In.	30-In.	24-In.	20-In.	18-In.	16-In.	12-In.	10-In.	8-In.	6-In.	4-In.	3-In.	Total.
Murdock	5	...	11	16	...	...	24	28	169	437	1,490	1,266	9	3,455
Flowers	20	...	9	18	...	...	...	...	39	52	240	437	22	837
Galvin	...	1	7	12	...	...	21	...	13	32	171	266	1	524
Michigan Brass and Iron Works	10	...	9	2	11	...	10	11	55	151	768	110	...	1,137
Pittsburg	...	...	...	13	...	2	1	1	9	11	30	126	...	193
Roe Stephens	...	...	...	...	...	...	...	6	....	4	43	....	...	53
Eddy	...	...	...	...	...	...	...	...	15	4	6	9	...	34
Scowden	...	...	...	...	...	...	...	...	3	2	....	....	...	5
Ludlow	...	...	...	...	...	...	...	...	1	3	11	12	...	27
Prong	...	...	...	...	...	...	...	...	....	....	1	....	...	1
Boston	...	...	...	...	...	...	...	...	....	1	1	....	...	2
Newport	...	...	...	...	...	...	...	...	....	....	....	1	...	1
No Name	...	..	...	...	...	...	...	...	....	3	9	32	1	45
Total	35	1	36	61	11	2	56	46	304	700	2,770	2,259	33	6,314

There were added to the system during the year 149 valves, 19 of which were old gates taken on previously and repaired by the men at the storage yard.

There were also taken out 23 gates, as shown in the second table following:

GATES ADDED TO SYSTEM, 1897.

NUMBER		KIND.	SIZE.
New.	Old.		
1	..	Michigan Brass and Iron Works	12 in.
7	..	Roe Stephens	12-in.
8	..	Michigan Brass and Iron Works	10-in.
..	1	Galvin	10 in.
9	..	Michigan Brass and Iron Works	8-in.
4	..	Roe Stephens	8 in.
43	..	" "	6-in.
58	..	Michigan Brass and Iron Works	6-in.
..	16	Murdock Valve Co	4-in.
..	2	Flower Bros	4 in.
130	19	Total.	

TABLE OF GATES TAKEN OUT.

No. of each kind.	KIND.	SIZE.	REMARKS.
1	Flower Bros	6-in.	From System (Shut-off).
1	Michigan Brass and Iron Works	6-in.	" " "
2	Flower Bros	4-in.	" " (Blow-off).
2	Murdock Valve Company	4-in.	" " (Shut-off).
12	" " "	4-in.	" " (Blow-off).
1	Michigan Brass and Iron Works	4-in.	" " (Shut-off).
1	" " " " "	4-in.	" " (Blow-off).
1	Pittsburg	4-in.	" " (Shut-off).
1	Galvin	4-in.	" " "
1	Ludlow	4-in.	" " (Blow-off).
23	Total.		

The following show the number of gates set for blow-offs on dead ends.

There are now in the system 359 of these dead ends, all of which are supplied with gates or valves, which are operated once in two weeks, and the stagnant water drawn off.

There are 30 other blow-off gates in the system, connected with the sewers, in various locations, for use in flushing the mains when necessary.

GATES SET AND RE-SET FOR BLOW-OFFS.

NUMBER.		KIND.	SIZE.	REMARKS.
New.	Old.			
3	..	Michigan Brass and Iron Works	6-in.	New.
1	..	Roe Stephens	6-in.	"
..	1	" "	6-in.	Re-set.
..	1	Murdock Valve Co.	6-in.	"
..	30	" " "	4-in.	New.
..	9	" " "	4-in.	Re-set.
..	6	Flowers Bros	4-in.	New.
..	4	" "	4-in.	Re-set.
1	..	Michigan Brass and Iron Works	4-in.	New.
..	1	" " " "	4-in.	"
..	2	" " " "	4-in.	Re-set.
..	2	Pittsburg	4 in.	New.
..	1	"	4-in.	Re-set.
5	57	Total.		

The following statement of the work of the men employed in the examination of gates and repairs thereof, shows the necessity there is for such work. Nearly 17 per cent of those examined were found out of order, and 17 found shut, the reason or cause for which is next to an impossibility to discover:

2,286 gates were examined.
378 were found out of order since January 1, 1897.
534 were repaired.
17 were found shut and opened.
17 were fitted with larger heads to stem.
135 new gates were opened.
58 gate wells were built.
247 gate wells were rebuilt and adjusted.
71 gate wells were cleaned out.
153 wood boxes were replaced with iron boxes.
247 boxes were readjusted to grade of street.
1,431 gates were shut and opened for various purposes.
78 blow-offs were repaired.
6,071 gate wells and boxes cleaned of snow and ice.

All of which is respectfully submitted.

L. N. CASE,
General Superintendent.

PIPE CONSTRUCTION, 1897.

The following is a detailed list of the total lines laid, giving locations, size of pipe and length of same:

DATE.	LOCATION.	DIAMETER IN INCHES.				
		4-in.	6-in.	8-in.	10-in.	12-in.
June 19...	Agnes st., w. line of Townsend to 27 ft. e. of same		27			
April 22. .	Annetta st., 23 ft. s. of n. of Caniff to 198 ft. n. of n. of same		221			
April 27...	Anthon st., 336 ft. w. of w. of Campbell to 251 ft. w. of w. of same		85			
May 20...	Antoinette st., 33 ft. e. of w. of Cass to 33 ft. e. of w. of Woodward			525		
July 18...	Alice st., 28 ft. e. of w. of Jos. Campau to 579 ft. w. of w. of same		608			
July 11...	Avery ave., n. line Grand River to 21 ft. n. of s. of Willis		760			
March 9...	Belvidere ave., 535 ft. n. of n. of Lorman to 17 ft. s. of n. of Louis		148			
July 12...	Belvidere ave., 284 ft. n. of n. of Jefferson to 395 ft. n. of n. of same		111			
July 23...	Brush st., s. line of Koch to n. line of same		60			
July 28...	Brush st., n. line of Koch to s. line of Melbourne			238		
Feb. 26...	Burlage pl., 20 ft. n. of n. of Cleveland to 3 ft. s. of s. of Hendricks		211			
July 26...	Burlage pl., 3 ft. s. of s. of Hendricks to 21 ft. s. of n. of same		31			
Nov. 16...	Burnett ave., 24 ft. w. of e. of VanDyke to 34 ft. e. of w. of Maxwell		596			
Oct. 11...	Cadillac ave., 48 ft. s. of n. of Mack to n. line of same					48
Oct. 11...	Cadillac ave., n. line of Mack to 178 ft. n. of n. of Warren					3,723
Oct. 30..	Cadillac ave., 178 ft. n. of n. of Warren to 38 ft. n. of s. of Moffat					793
....	Cameron ave., 97 ft. n. n. line of Haigh to 11 ft. s. of n. of Alger		173			
Nov. 25...	Cameron ave., 12 ft. s. of n. of Alger to 30 ft. n. of s. of King		230			
Nov. 11...	Canfield ave., 43 ft. w. of e. of Baldwin to 334 ft. e. of e. of same		377			
April 21...	Caniff ave., 26 ft. e. of w. of Oakland to 30 ft. e. of w. of Annetta		177			
April 29...	Christiancy st., 26 ft. w. of e. of Campbell to 267 ft. e. of e. line of same		295			
April 18...	Commonwealth ave., 32 ft. s. of n. of Merrick to s. line Kirby		488			
Nov. 29...	Dallas st., 10 ft. e of w. of Greely, 8 ft. w of w. line D. & M. R. R. property		602			
Oct. 4...	Delaware ave., 14 ft. e. of w. of Third to 300 ft. w. of w. of Second		566			
Aug. 18...	Eighteenth st., 45 ft. n. of n. of Linden to 8 ft. s. of s of Poplar		491			
March 18...	Eldred st., 27 ft. w. of e. of Cavalry to 197 ft. e. of e. of Campbell		801			
Nov. 23...	Eldred st., 197 ft. e. of e. line of Campbell, 27 ft. w. of e. of Junction		386			
Dec. 2...	Ellery st., 23 ft. s. of n. of Canfield to 25 ft. s. of n. of Garfield		422			
Aug. 8...	Euclid ave., 24 ft. e. of w. of Hamilton Boulevard to 18 ft. e. of e. of same		60			
June 21...	Farnsworth st., 27 ft. e. of w. of Helen to 2 ft. e. of e. of same		38			
Nov. 18...	Ferry ave., 21 ft. e. of w. of Baldwin to 25 ft. w. of e. of VanDyke		598			
July 27...	Fifteenth st., n. line Milwaukee to 1 ft. n. of s. of N. Boulevard		368			
March 23...	Forest ave., 164 ft. e. of e. of Baldwin to 25 ft. w of e. of VanDyke		492			
Sept. 18...	Frontenac Boulevard (w. side), 10 ft. n. of n. of Jefferson to 13 ft. n. of n. of Champlain		1,286			
Oct. 15...	Frontenac ave., 26 ft. s. of n. of Medbury to 26 ft. n. of s. of Lambert		592			

PIPE CONSTRUCTION, 1897—CONTINUED.

DATE.	LOCATION.	DIAMETER IN INCHES.				
		4-in.	6-in.	8-in.	10-in.	12-in.
Dec. 2	Garfield ave., 25 ft. w. of e. of Ellery to 252 ft. e. of e. of same		278			
Aug. 8	Gilbert pl., w. line Hamilton Boulevard to 37 ft. e. of same		37			
April 10	Grand ave. (Highland Park), 25 ft. w. of w. of Woodward to 18 ft w. of e. of same		108			
Oct. 5	Grand ave. (Highland Park), 332 ft. w. of w. of Woodward to 25 ft. w. of w. of same		806			
Feb. 11	Glynn Court, 328 ft. w. of w. of Woodward to 306 ft w. of w. line of same	22				
Sept. 18	Guoin st., alley s. of 25 ft. w. of e. of Leib to 5 ft. e. of e. of same		30			
Sept. 18	Guoin st., alley s. of 5 ft. e. of e. of Leib to 37 ft. e. of e. of same	32				
Sept. 2	Hamilton Boulevard, n. line of n. Boulevard to 56 ft. n. of n. of Virginia				2,479	
Sept. 2	Hamilton Boulevard, 56 ft n. of n. line of Virginia to 18 ft. s. of s. of Blaine				1,226	
June 19	Hammond ave., 28 ft. s. of n. of Norton to 189 ft. n. of n. of same		217			
April 7	Hancock ave., 157 ft. w. of w. of Sixteenth to 33 ft. e. of w. of same		190			
July 20	Hancock ave., 27 ft. w. of e. of Maybury to 3 ft. e. of e. of same		30			
Oct. 11	Harper ave. (alley s. of). 384 ft. w. of w. of Rivard to 19 ft. w. of e. of same		411			
May 22	Helen ave., 192 ft. n. n. line of Medbury to 426 ft. n. of n. of same		234			
Nov. 16	Helen ave., 116 ft. s. of s. of Lambert to 26 ft. n. of s. of same		141			
Nov. 1	Hennepin ave. (Hecker's sub-division), 4 ft. s. of n. of alley n. of Lamont to 4 ft. s. of n. of alley s. of LaForest		980			
Nov. 1	Hennepin ave. (Hecker's sub-division) alley w. of 4 ft. s. of n. of LaSalle Gardens, s. to 4 ft. n. of s. of LaSalle gardens n.		448			
July 6	Holbrook ave., 13 ft. e. of w. line of John R. to w. line of Brush		720			
July 8	Hunt st., 427 ft. e. of e. of Elmwood to 526 ft. e. of e. of same		99			
April 9	Ida pl., 14 ft. w. of e. of Scotten to w. line of second alley e. of same		385			
May 29	Ingersoll st., w. line of Junction to e. line of same		56			
July 17	John R. st., s. line of Koch to 1 ft. n. of n. line of same		61			
July 18	Joseph Campau ave. (Hamtramck), 9 ft. n. of n. of Denton to 13 ft. s. of n. of Alice		141			
May 29	Julia st., w. line of Junction 12 ft. e. of w. of same		12			
May 29	Junction ave., 21 ft. n. of s. of Otis to 22 ft. s. of n. of Michigan			978		
April 10	Kanter ave., 223 ft. w. of w. of Mt. Elliott to 164 ft. w. of w. of same		59			
Nov. 25	King ave., 71 ft. w. of w of Cameron to 45 ft. e. of w. of same		117			
Feb. 25	Kirby ave., 6 ft. e. of e. of Collins to 86 ft. w. of w. of Moran		588			
Sept. 24	Lafayette ave., alley s. of, 22 ft. w. of e. of Shelby to 8 ft. w. of w. of Griswold			346		
July 8	Lansing ave., 377 ft s. s. line Dix to 340 ft. s. of s. of same		37			
Nov. 1	LaForest ave. (Hecker's sub.), 5 ft. e. of w. of Nicollette to 3 ft. e. of w. of Fourteenth		1,346			
Nov. 1	LaForest ave., alley s. of Hecker's sub., 4 ft. e. of w. of Nicollette to 4 ft. w. of e. of alley w. of LaSalle		292			
Nov. 1	LaForest ave., alley s. of Hecker's sub., 4 ft. w. of e. of Hennepin to 4 ft. e. of w. of alley e. of LaSalle		397			

Nov. 1	LaSalle ave. (Hecker's sub.), 40 ft. s. of N. Boulevard to 4 ft. s. of n. of alley n. of n. Boulevard			261		
Nov. 1	LaSalle ave., alley w. of Hecker's sub., 4 ft. s. of n. of alley n. of N. Boulevard to 4 ft. s. of n. of alley n. of LaMotte		960			
Nov. 1	LaSalle ave., alley w of Hecker's sub., 4 ft. s. of n. of alley s. of LaForest to 4 ft. s. of n. of LaForest		245			
Nov. 1	LaSalle ave., alley e. of Hecker's sub., 4 ft. s. of n. of alley n. of N. Boulevard to 4 ft. s. of n. of alley n. of LaMotte		960			
Nov. 1	LaSalle ave., alley e. of Hecker's sub., 4 ft. s. of w. of alley s. of LaForest to 4 ft. s. of n. of LaForest		245			
Nov. 1	LaSalle gardens, south (Hecker's sub.), 4 ft. e. of w. of LaSalle gardens west to alley w. of Hennepin		680			
Nov. 1	LaSalle gardens, north (Hecker's sub.), 4 ft. e. of w. of Nicollette to 4 ft. e. of w. of LaSalle gardens west		270			
Nov. 1	LaSalle gardens, north (Hecker's sub.), 4 ft. e. of w. of alley w. of Hennepin to 4 ft. w. of e. of Hennepin		207			
Nov. 1	LaSalle gardens, west (Hecker's sub.), 4 ft. s. of n. of LaSalle gardens south to 4 ft. n. of s. of LaSalle gardens north		448			
Nov. 1	LaMotte alley, n. of Hecker's sub., 3 ft. e. of e. of Eighteenth to 4 ft. e. of w. of alley w. of LaSalle		585			
Nov. 1	LaMotte alley, n. of Hecker's sub., 4 ft. e. of w of alley e. of LaSalle to 3 ft. w. of e. of Fourteenth		582			
Nov. 1	Lothrop alley, n. of Hecker's sub., 4 ft. e. of w. of alley e. of LaSalle to 3 ft. w. of e. of Fourteenth	582				
Nov. 1	Lothrop alley, n. of Hecker's sub., 4 ft. e. of w. of alley w. of LaSalle to 3 ft. e. of e. of Eighteenth	584				
July 21	Lothrop ave., w. line of Hamilton boulevard to 38 ft. e. of w. of same		38			
March 10	Louis ave., 83 ft. e. of e. of Holcomb to 25 ft. e. of w. of McClellan		489			
Nov. 18	Lambert st., 25 ft. e. of w. line of Helen to 24 ft. of w. of Frontenac boulevard		497			
Sept. 18	Leib st., 289 ft. s. of n. of Guoin to 28 ft. n. of s. of Wight		313			
March 26	McDougall ave., 26 ft. n. of s. of Farnsworth to 100 ft. n. of n. of same		134			
May 26	McMillan ave., 156 ft. w. of w. of Campbell to 26 ft. w. of e. of same		195			
May 22	Maple st., 1 ft. e. of w. of Chene to 4 ft. e. to e. line of same		61			
Oct. 26	Melbourne ave., 27 ft. e. of w. of Oakland to 211 ft. e. of e. of same		249			
March 19	Meldrum ave., 375 ft. s. of s. of Berlin to 226 ft. s. of same		149			
Aug. 8	Montrose ave., 3 ft. w. of w. of Hamilton boulevard to 37 ft. e. of w. of same		40			
April 19	Moore pl. (outside limits,) 182 ft. w. of w. line of Scotten ave. to 14 ft. e. of w. of same		196			
May 22	McKinley ave., 243 ft. s. of s. line of Grand River to 36 ft. n. of s. of same		379			
Oct. 28	McKinley ave., 2 ft. n. of n. line of Scovel to 343 ft. s. side Grand River		350			
Nov. 1	Nicollette ave. (Hecker's sub.), 4 ft. s. of n. of alley n. of LaMotte to 4 ft. s. of n. of alley s. of LaForest		980			
Nov. 1	North boulevard (Hecker's sub.), alley n. of, 4 ft. e. of w. of alley e. of LaSalle to 3 ft. w. of e. of Fourteenth	582				
Nov. 1	North boulevard (Hecker's sub.), alley n. of, 4 ft. e. of w. of alley w. of LaSalle to 4 ft. e. of w. of alley e. of LaSalle		480			
Nov. 1	North boulevard (Hecker's sub.), alley n. of, 3 ft. e. of e. of Eighteenth to 4 ft. e. of w. of alley w. of LaSalle	582				
Nov. 1	North boulevard (Hecker's sub.), s. side, 148 ft. e. of e. of Sullivan to 1 ft. e. of w. of Eighteenth		512			
June 4	North boulevard, s. side, 162 ft. w. of w. of Mt. Elliott to 13 ft. e. of w. of same	179				

PIPE CONSTRUCTION, 1897—CONTINUED.

DATE.	LOCATION.	DIAMETER IN INCHES.				
		4-in.	6-in.	8-in.	10-in.	12-in.
Feb. 27	Norton ave., 248 ft. w. of w. Wesson to 160 ft w. of w. of same		88			
June 19	Norton ave., 12 ft. e. of w. of Hammond to 245 ft. w. of w. line of Wesson		132			
Aug. 2	Oakland ave., 15 ft. s. of n. of Westminister to 35 ft. n. of n. of same ... lead 91 ft					
Aug. 5	Oakland ave., 33 ft. n. of s. of Sidney to 27 ft. s. of n. of Philadelphia				334	
Oct. 30	Page st., 16 ft. w. of e. line of Scotten to 369 ft. e. of e. line of same		385			
Nov. 12	Pallister ave., 260 ft. w. of w. of Merrill to 258 ft. w. of w. of Hamilton boulevard		1,041			
Sept. 1	Pallister ave., crossing Hamilton boulevard		62			
Oct. 8	Palmer ave., 25 ft. e. of w. of Helen to 4 ft. e. of e. of same		42			
Dec. 21	Parker ave. 26 ft. n. of s. of Worcester to 6 ft n. n. line of Goethe		612			
Sept. 1	Parkman ave., 31 ft. e. of w. of Hamilton boulevard to 12 ft. e. of e. of same		60			
Sept. 9	Pennsylvania ave., 613 ft. n. of n. of Kercheval to 861 ft. n. of n. of same		248			
Aug. 5	Philadelphia ave., 22 ft. e. of w. of Oakland to 206 ft. e. of e. of same		250			
July 21	Putnam ave., 28 ft. w. of e. of Maybury to 3 ft. e. of e. of same		229			
March 20	Putnam ave., east of Trumbull ... lead, 137 ft.					
Oct. 6	Second ave., crossing Delaware		67			
March 22	Second ave., alley w. of, 25 ft. n. of s. of Merrick to 24 ft. n. of s. of Kirby		517			
Nov. 6	Seventh st., 688 ft. n. of n. of Stanley to 4 ft. s. of s. of B. C. R. R.		352			
Aug. 9	Sidney ave., 25 ft. e. of w. of Oakland to 292 ft e. of e. of same		331			
July 7	Sterling ave., 26 ft. n. of s. of Holden to ft. s of n. of same		36			
Aug. 4	St. Antoine st., 26 ft. n. of s. of Koch to ft. n. of n of same		40			
July 12	Third ave., 9 ft. n. of s. of Hazelwood to t. s. of n. of same		54			
Oct. 18	Thirtieth st., 26 ft. s. of n. of Devereaux to 36 ft. s. of s. of Herbert		800			
Oct. 11	Thompson court, 117 ft. n. of n. of Forest to 224 ft. n. of n. of same		107			
Oct. 18	Tillman ave., 101 ft. n. of n of Merrick to 300 ft. n of n. of same		199			
Nov. 11	Trowbridge ave., 51 ft. e. of e. of Woodward to 25 ft. e. of w. of Oakland		2,140			
July 15	Trombley ave., 20 ft. e. of w. of Dubois to 132 ft. e. of e. of same		162			
Oct. 13	Warren ave., 177 ft. e. of e. of Mt. Elliott to w. line of Beaufait		583			
Oct. 9	Welch ave., 122 ft. n. of n. of Otis to 282 ft. n. of n. of same		160			
Dec. 3	Welch ave., 71 ft. s. of s. of Otis to 122 ft. n. of n. of same		254			
June 5	Westminster ave., 1222 ft. e. of e. of Woodward to w. line of Oakland		1,407			
June 5	Westminster ave., at Oakland ... lead, 23 ft					
Oct. 23	Woodland ave., 844 ft. w. of w. line of Oakland to 30 ft. e. of w. line of same		874			
Oct. 28	Woodland ave., 780 ft. e. of e. of Woodward to 844 ft. w. of w. of Oakland		1,004			
Sept. 6	Woodward ave. (Highland Park), n. line of Moss to 10 ft. n. of n. of Stevens				700	
Aug. 1	**Woodward ave.** (Highland Park), **Venture Meter** ... lead, 250 ft.	7	94	41		15
July 15	**Woodward ave.** (Club House) ... 3 in., 36 ft.					

REPORT OF THE CIVIL ENGINEER.

Detroit, Mich., February 8, 1898.

To the Honorable Board of Water Commissioners of the
City of Detroit:

Gentlemen—Complying with the regulations, I have the honor to submit the following report of "such operations as have properly come under my supervision" during the past year.

Although 1897 has been a year of very limited construction, and one remarkable in the history of these works for the low consumption of water, which has only amounted to 125.4 gallons per consumer daily, thus considerably reducing the work demanded in some other departments, owing to a number of special causes the calls upon the Engineering Department have been greater than usual.

The preparation of plans for new construction has been of only limited consequence, but has entailed fully as much work as the larger amount of similar construction last year, owing to the greater detail and more comprehensive and accurate information required under the new law controlling pipe extensions, and to the transfer to this department by your General Superintendent of some duties formerly discharged by the Superintendent of Extensions.

A small amount of construction work, comprising the transfer of the outfall of the twenty-four-inch sewer draining the Pumping Station from its previous location at the head of the ship canal, to the head of the lagoon about four hundred feet west, was carried out under the direction of this Department by orders of the General Superintendent and the Committee on Pumping Station, the cost amounting to $935.56. Contracts to the amount of $1,396.00 have been entered into for foundation and frame work of a building to be erected at the Pumping Station to serve as a Library and Boat House, and the work begun under our supervision.

The preservation and perfection of our records of construction, which forms the second division of the work under my care, has thus far had very little dependence upon current construction, owing to the fact that previous to 1893 no systematic attempt was made to preserve or place the records of the construction of these works in a convenient form for reference. A system of foremen's reports had been growing up since 1883, which gave so much information relating to their operations as the ordinary foremen of construction gangs were able, or thought it worth while, to transfer to paper. Previous to these reports, there were filed some of the memorandum note books kept by these foremen in the field, and still earlier than that, a series of note books kept by the Superintendent of Construction and his assistants, which were really of more value than the later series, but the data contained in all of these old records were meager and often indefinite. From these, and from measurements taken from time to time upon the surface, gate books were prepared showing the location of the various gates in the system. Later, the several note book entries were posted into a kind of journal which was indexed in annual volumes. A few drawings had been made of some of the more complicated street intersections, but as it seems to have been customary for the foremen to deviate from the plans of the Superintendent, often only guided by their own supposedly more perfect knowledge of the principles of water works construction, it was never possible to be assured that these drawings represented the true state of affairs. The Annual Reports and several large maps of the city, of various dates, to a scale of 300 feet to the inch, upon which the water pipe had been indicated by fine lines of red ink, with the sizes marked upon them in small figures, no other attempt being made to distinguish between large and small mains, completed the available records of this office bearing upon nearly three millions of dollars' worth of property buried in the streets and alleys of the city and the roads of the surrounding townships. Former Commissioners, failing to appreciate that Detroit was to become a great city, and that servants, however faithful, would not live forever, had been content to allow the details of the system to be recorded only in the brains of a few old and trusted employes, and the last one of these had just died when, in 1893, the records of these works were placed in the care of your Civil Engineer, then newly appointed. The plan was at once adopted of making a drawing of each street and alley intersection upon which should be indicated all the information which could be obtained concerning our construction in it. As each drawing could be made to include whatever there was of interest within half the distance to the next each way, this system would furnish a complete record of what we know of every street. At first these drawings were made to show only the locations of the water pipes, and even this information was sometimes uncertain, but finding that nowhere in the city was there being kept anything approaching to a comprehensive record of the property in our streets, and as such a record would be of more value to us than to any other single department, and is, in fact, indispensable to the economical design of extensions and improvements to our system, it was decided to place upon our drawings such information as we might obtain relating to construction other than our own.

The result is that while these drawings, even the best of them, are far from complete, we nevertheless have a more accurate and comprehensive record of the underground work in the public highways of our city than is to be found in any other department. Plate I, on the opposite page, represents a typical down town intersection. Our drawings show only what we know to exist, unless the information is marked "doubtful," and they can be relied upon as being as nearly accurate as any that can be made. The drawings in this office now cover about 3,500 street intersections, and range in completeness from the older ones of outlying streets, showing only the water pipe and the property lines, to those within the half-mile circle, of which Plate I. is representative.

The general conditions affecting the operation of the Works have presented no especial features during the year, beyond the appearance in our water during the spring and early summer months of extensively distributed Algae growths. These growths did not seem to greatly affect the taste or odor of the water, and so far as has yet appeared are not deleterious to health, although their accumulations in service connections frequently were sufficient to cause complaints of short supply, and owing to particles being discharged through the taps produced many reports of "bad water." As is usual with these plants, they very largely disappeared later, and have caused but little annoyance during the last four months. In consequence of the presence of these organisms, more attention was paid to systematically blowing off our mains than previously.

The result obtained by the laying of the 30-inch main from the intersection of Scott and Orleans streets to the Canfield avenue 42-inch, the completion of which was recorded in the last annual report, is well shown by a comparison of the records for the first week in November of the two years 1896 and 1897, when conditions affecting

Post Office Building

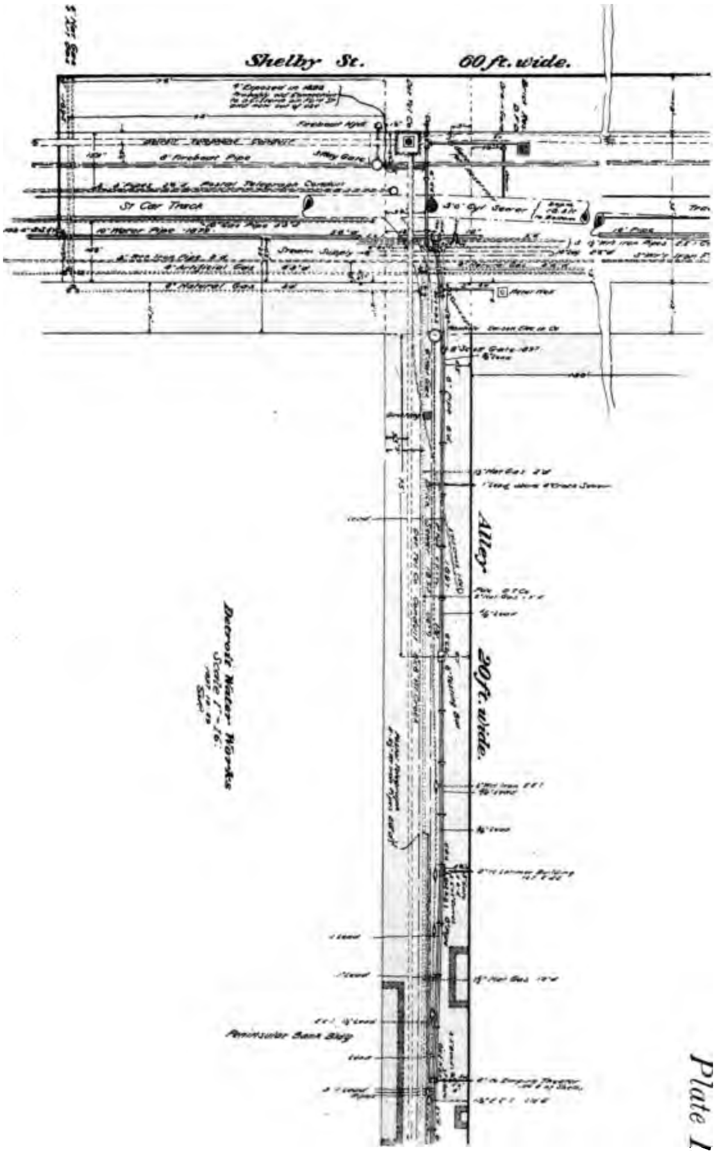


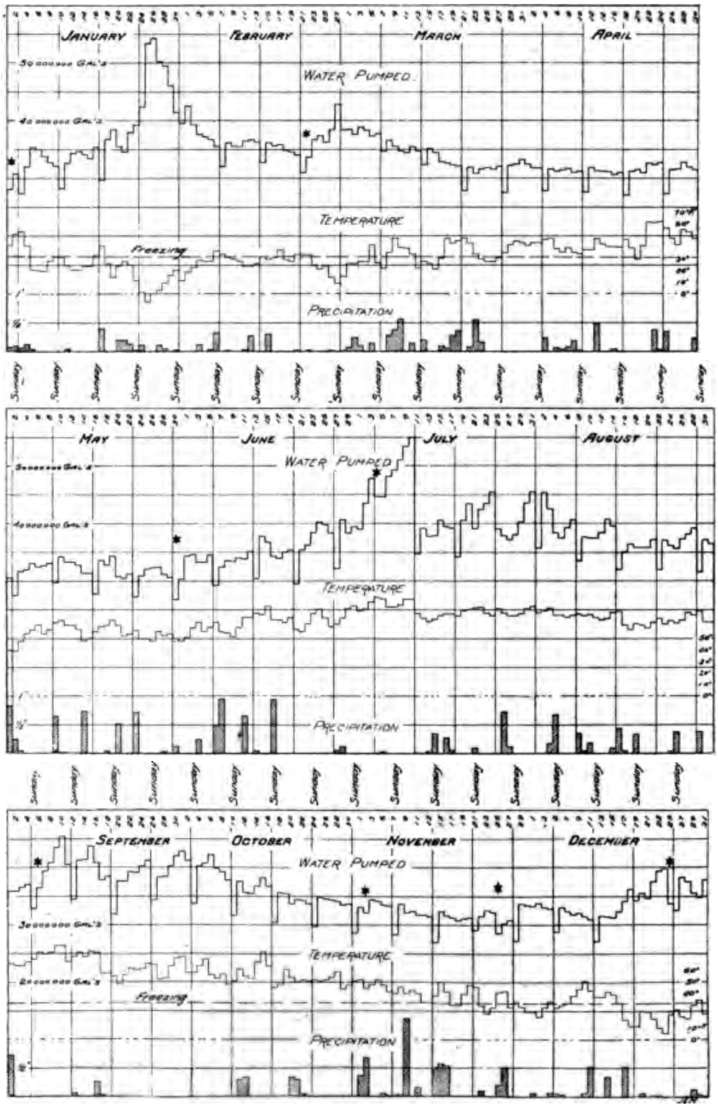
Plate I.

our system were practically the same, except for the 30-inch main, which was operative only in the latter. The quantity of water pumped was very nearly the same, being at an average of 38,974,000 gallons daily in the former period and 38,898,400 gallons in the latter. An increase of pressure at the engines in the latter period amounting to 0.9 pounds is accompanied by an increase on the territory included in the upper district averaging 2.35 pounds, a net gain of 1.45 pounds, or about 3¼ feet in elevation on the high points of the system. The pressures in the lower districts, where formerly there was a surplus, show a mean net decrease of 0.29 pounds, or about 8 inches of elevation. In other words, by reducing the hight to which water will rise in the lower part of the city an average amount of 8 inches, with the aid of the 30-inch main, the hight to which it will rise in the upper districts has been increased 3¼ feet, or almost five times as much as the decrease.

Plate II., page 55, shows the relations between the daily water pumped, represented by the upper lines of the charts, and the temperature and precipitation. The effect of cold weather, which causes people to leave fixtures running to prevent freezing, is shown very clearly by the last week in January, when the cold weather caused an excess of about 20,000,000 gallons daily in the water consumed, and similar effects, but less important, are shown at the end of February and in the latter part of December. Hot weather effects are best exemplified in July, and the result of a rain, even though insignificant in quantity, is clearly apparent in the reduction of consumption between July 10 and 11, amounting to 20,000,000 gallons, more than three-fourths of which was due to rain and accompanying fall of temperature, and is an indication of the amount of water used for sprinkling and cooling purposes. The period of minimum consumption, as usually, came in November, and the decrease of consump-

Plate II

1897 DAILY WATER PRECIPITATION AND TEMPERATURE



* Legal Holidays.

tion of water on Sundays and holidays is clearly defined throughout the entire year.

The investigation into the character of our water supply. etc., has comprised during the past year, work of greater importance than, I might almost say, all of the rest. This may be classed under two heads, the investigation of existing conditions and the study of those in years past. The former has included principally a systematic survey and study of the currents in the Detroit River passing our intakes, and the courses of the shore waters flowing into the river between Windmill Point and the Water Works property. These latter are Connor's and Fox Creeks, which together drain an area of about eighty-seven square miles, having an average population of ninety per square mile. The surveys were begun during the summer of 1896, but we were unable to make very successful progress until opportunity was afforded for working on the ice. As soon as the river was safely frozen over, a system of soundings was started at the west line of the Water Works property and carried up the American Channel and along the American shore to within about fifteen hundred feet of the Windmill Point Light House. As soon as the ice began to move in the spring we commenced taking observations to determine the lines of demarkation, at times very decided, between the currents of clear and those of muddy or turbid water flowing down the American Channel. Floating ice rendered this work rather hazardous in a light open boat, and the observations, on this account, were not so complete as was desired, but showed that for a few days, while turbid water was being taken in at our intakes, a current of much clearer water was flowing past them a few hundred feet further out, but by the time the ice was gone the turbidity appeared practically uniform throughout the channel. The water from the office tap showed the greatest amount of sediment about March 10, at which time clear water was flowing beyond the intakes, but on March 19 the clear water had disappeared and the water from the tap was nearly as turbid as before.

The flows of Connor's and Fox Creeks were gauged by rod floats at flood discharge and were found under those conditions to be about 780 and 150 cubic feet per second respectively. The discharge of the American Channel was estimated by float measurements in the summer to be about 65,000 cubic feet per second, and by current meter readings later in the season, at about 53,750 cubic feet. By the latter means, the discharge when the surface was covered with ice, the Canadian Channel being open, was found to be reduced to about 36,000 cubic feet per second. It is, therefore, seen that the combined maximum or flood discharge of Connor's and Fox Creeks is only about two per cent of the minimum flow of the American Channel, which latter could not possibly occur at the time of the former.

As soon as the ice was fairly out of the way, floats of different lengths were started out of the mouth of Connor's Creek and at various points beyond the extremity of the breakwater, and their courses and velocities observed. This work was continued at frequent intervals during the entire open season, the floats being started at various points in the channel opposite Windmill Point, and in addition observations of the velocities and directions of the currents have been taken at various points by means of the Ritchie-Haskell Direction Current Meter, both during the open season and through the ice. The floats used consisted of a light pole with a can about 12 inches in diameter and 14 inches in length attached at the bottom for the purpose of making the current at the bottom of the float the controlling element in determining its course. As a counterbalance it was found necessary to attach a small can about 4x6 inches in section near the top of the pole. The center of gravity of the projected area of the pole and cans is represented on the sectional diagrams following by a circle on the line of the float.

Plate III., opposite page 58, shows the portion of the river examined and the courses of some of the floats, and also the courses of vessels up and down the river, together with a description of the floats and the conditions under which they were run. The elevations of water surface are referred to mean tide in the Atlantic Ocean.

Plate IV., page 59, shows a sectional elevation of the river at Windmill Point, with the floats in their relative lengths. Plate V. shows a sectional elevation at the Water Works Dock, with the floats that came through to that point, and also shows the position of the intakes. The different floats may be readily identified by their letters and numbers.

Tracing the courses of the different floats, it becomes easily apparent that the water of Connor's Creek does not mix with the water in the upper fifteen feet of the river sufficiently to reach our intakes. To determine whether in the lower layers of the stream a current exists that would carry the shore water out to the intakes, requires more sensitive apparatus than that which we have thus far used, and, in fact, than anything to be obtained upon the market. To enable us to examine the currents near the bottom of the river we have accordingly designed some special and very sensitive instruments, which we purpose using in the early spring and summer, to settle finally where the water comes from that passes into our intakes.

At the beginning of cold weather the water in the shallow portions of the river and in its tributary streams will cool more quickly than that which flows in the deeper parts of the stream from Lake Huron; consequently, by observing the temperatures in the different parts of a cross section, it would be possible, from their variation, to determine very accurately what part was at

Plate III.

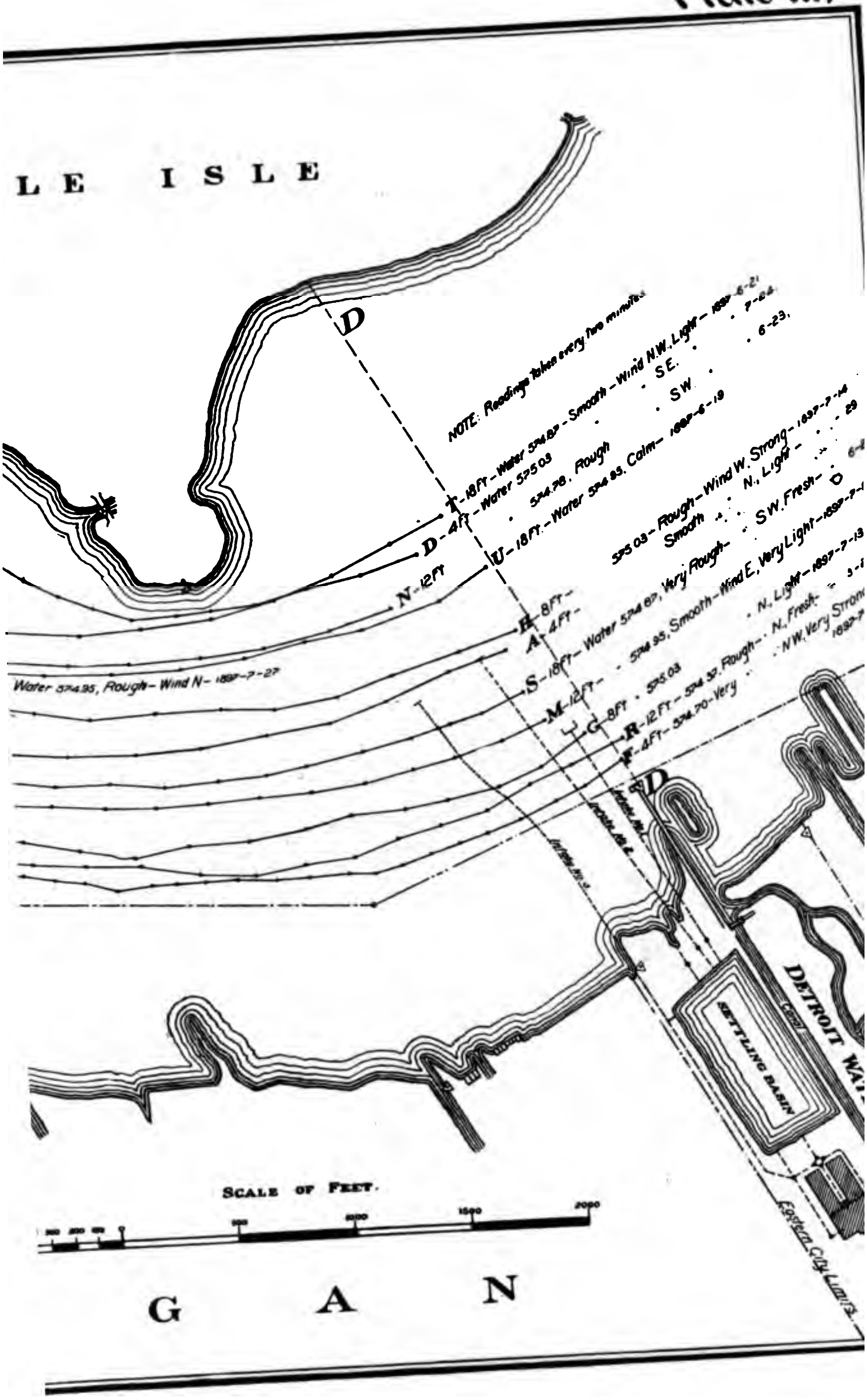

L E I S L E
D
NOTE: Readings taken every two minutes
T-18 Ft-Water 574.87-Smooth-Wind N.W. Light-1897-6-21
D-4 Ft-Water 575.03 • • S.E. • • 7-24
• 574.78, Rough • • S.W. • • 6-23.
U-18 Ft.-Water 574.85, Calm-1897-6-19
N-12 Ft
575.03-Rough-Wind W. Strong-1897-7-14
Smooth • • N., Light- • • 29
• • S.W. Fresh- • 6-
H-8 Ft-
A-4 Ft-
S-18 Ft-Water 574.87, Very Rough- • • Wind E, Very Light-1897-
• 574.95, Smooth-Wind E, Very Light-1897-7-13
M-12 Ft- • N., Light-1897-
G-8 Ft • 575.03
R-12 Ft-574.37, Rough- • N., Fresh- • 3-
F-4 Ft-574.70-Very • • N.W. Very Strong
1897-
Water 574.95, Rough-Wind N-1897-7-27
D
Intake No. 1
Intake No. 2
Intake No. 3
DETROIT WAT
SETTLING BASIN
Canal
Eastern City Limits
SCALE OF FEET.
500 400 300 200 100 0 500 1000 1500 2000
G A N

Plate IV.

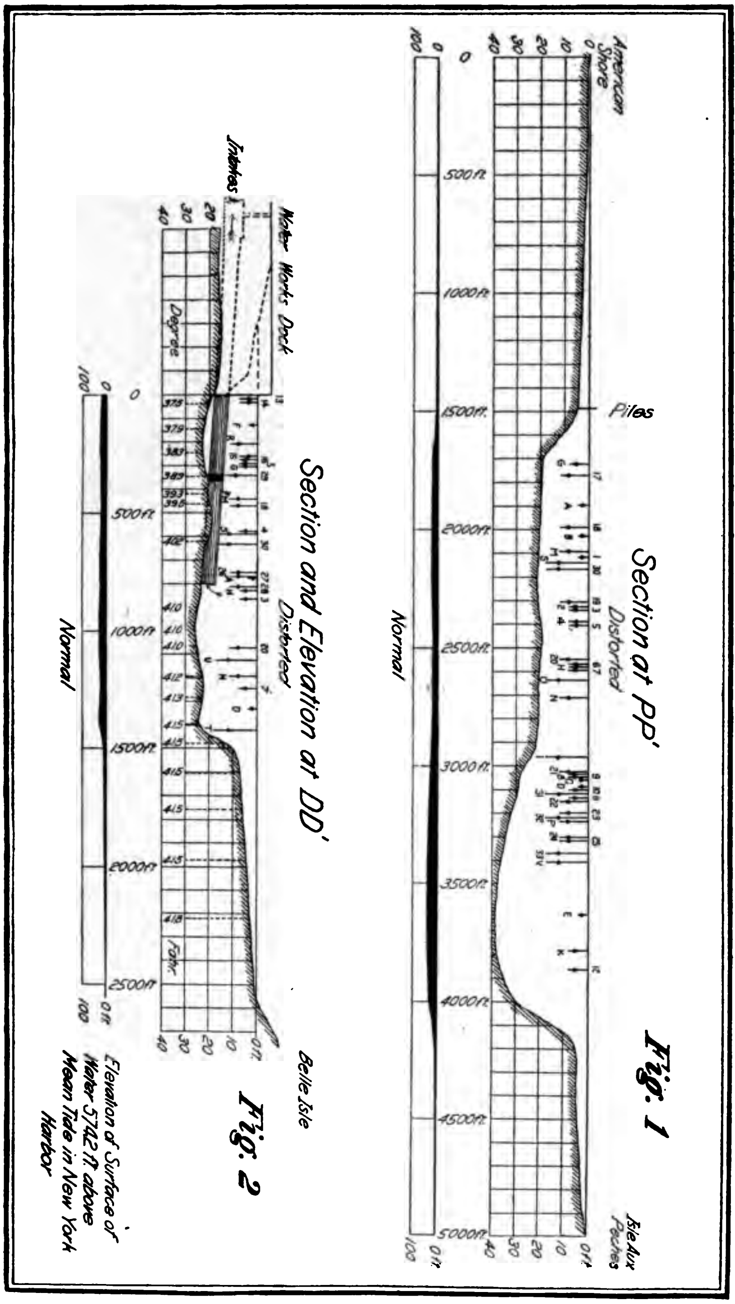


Fig. 1

Section at PP'
Distorted

Fig. 2

Section and Elevation at DD'
Distorted

Elevation of Surface of Water 574.2 ft. above Mean Tide in New York Harbor that time carrying shore water and what part lake water. In Figure 2 of Plate IV., page 59, are given the mean temperatures in several verticals of the section, and as it was found that the temperature in a single vertical did not vary more than one-fourth of a degree, these mean temperatures show very clearly where the shore wash was flowing. From this it appears that at the time of the observation it did not reach the outer intakes.

As there are only a few days in a year when the differences of temperature between the two currents is sufficient to serve for their differentiation, these investigations are somewhat limited, but so far as they have gone the results are reassuring to those who have feared contamination of our supply from Connor's Creek and the territory below it. As to Fox Creek, our information is yet too incomplete to permit us to draw inferences.

Traditions have long existed among fishermen and others that there flows somewhere in the American Channel a current of water much colder than the rest of the stream, and a therefore most desirable source from which to draw our supply in the summer. A careful series of temperature readings has, however, failed to locate it, or even show the probability of its existence. The temperature of the water in the river has been found to be very nearly uniform in all parts of the stream during the summer months, a difference of more than one degree Fahrenheit being very rarely observed in the same cross section.

All of which is, gentlemen, very respectfully submitted.

GARDNER S. WILLIAMS,
Civil Engineer.

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

DETROIT, January 10, 1898.

To the Board of Water Commissioners:

GENTLEMEN—In compliance with the rules and regulations of your honorable body, I herewith report the work done in the Meter, Inspection, Service Cocks and Repairing Leaks Departments during the year 1897.

The following table shows the number of meters placed during the year and the total number in service January 1st, 1898:

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
In service Jan. 1, 1897	2,472	922	721	173	176	72	42	6	4,584
Placed during the year 1897	648	118	25	12	7	3	1	......	809
Total number in service Jan. 1, 1898	3,120	1,035	746	185	183	75	43	6	5,393

The following table shows the total number of meters in service, the different kinds and sizes, and also the number of indicators attached to hydraulic elevators:

IN SERVICE JANUARY, 1, 1897.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson	3,070	1,013	653	171	147	58	28	6	5,146
Crown	30	14	45	10	12	8	4	......	123
Hersey	1	4	32	2	11	2	7	......	59
Worthington	10	4	16	......	12	7	2	......	51
Union Rotary	8	......	......	2	1	......	1	......	12
Buffalo	1	......	......	......	......	......	......	......	1
Venturi	......	......	......	......	......	......	1	......	1
Aggregate	3,120	1,035	746	185	183	75	43	6	5,393

Indicators attached to hydraulic elevators 15

METERS IN STOCK.

KIND.	SIZES.						
	⅝ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Thomson	11	......	5	2	2	.....	20
Crown	......	......	......	1	1	......	2
Hersey	......	8	.....	1	......	1	10
Aggregate	11	8	5	4	3	1	32

Valuation of meters in stock January 1, 1898		$791 00
Valuation of material on hand January 1, 1898		523 47
Valuation of tools January 1, 1898		481 42
Valuation of horse, wagons, etc., January 1, 1898		285 00
Valuation of furniture and fixtures		100 00
Total valuation of stock on hand January 1, 1898		$2,180 89
Valuation of meters in service January 1, 1897	$97,484 65	
Deduct 10 per cent for depreciation in value	9,748 46	
		$87,736 19
Add amount expended during the year for meters placed	15,361 35	
Less amount received for meters sold	166 38	
		15,194 97
		$102,931 16
Less stock on hand January 1, 1898,		2,180 89
Total valuation of meters in service January 1, 1898		$100,750 27
Cost of material used in repairing meters, 1897	$296 26	
Cost of labor repairing meters, 1897	1,029 00	
		$1,325 26
Less amount received for repairing meters		28 25
Total cost of repairs		$1,297 01

SUMMARY OF TOTAL AMOUNT EXPENDED IN THE METER DEPARTMENT FOR THE YEARS 1889 TO 1897, INCLUSIVE.

	1889	1890	1891	1892	1893	1894	1895	1896	1897	TOTAL.
Meters..........	$11,175 00	$18,700 00	$6,501 55	$12,371 82	$6,987 43	$8,824 08	$9,235 11	$10,435 76	$7,955 97	$92,186 72
Supt. and labor..	1,734 10	8,510 57	4,841 49	8,269 17	8,980 48	6,672 20	6,647 89	6,840 08	6,078 78	58,074 76
Material, tools, etc.	637 26	2,982 14	872 99	2,132 93	1,650 33	1,833 01	1,384 85	1,035 15	927 90	13,456 56
Freight, hauling, etc............	98 05	408 97	197 11	244 08	165 12	201 18	71 40	91 11	67 90	1,544 92
Horses, wagon, etc.	....	....	....	547 24	184 50	383 07	248 60	238 51	330 80	1,932 72
Aggregate..	$13,644 41	$30,601 68	$12,413 14	$23,565 24	$17,967 86	$17,913 54	$17,587 85	$18,140 61	$15,361 35	$167,195 68

As will be seen by the foregoing, we have now 5,393 meters in service, having placed 809 during the past year, 781 of which were placed previous to the time the minimum rate for meters was increased and the estimated rates reduced to a point which stopped all requests for meters for domestic purposes other than apartment houses, or where one service connection supplied several buildings.

Many metered premises are now being transferred to the assessment rolls. Estimated rates on the ordinary house, containing bath, closet, etc., being less than the minimum rate for meters ($9 per annum), causes the change.

There are a number who are now using more than the maximum quantity allowed for 75 cents per month, but whose estimated rate will be much less, and they are fully as anxious to make the change as those who do not use up to the limit. I believe it would be wise to allow more to make the transfer who are using more than 75 cents' worth each month, and whose estimated rate will be 50 cents or less.

While those making the transfer will pay by the assessed rate, the fact of the meter being allowed to remain on the premises will act—in most cases—as a preventative of waste, as much so, probably, as though they continued to pay by meter rates, as the possibility of having to pay for any excess over the estimated quantity will prevent useless consumption.

While the meter remains on the premises it will act as a permanent inspector, as it is one of the best leak detectors known.

We have a $\frac{5}{8}$-inch meter covering three houses occupied by five families. There is one closet and one sink in each house, the estimated rates on the whole being $14.20. During the past year they consumed 2,229,750 gallons, for which the owner paid $55.47. Since the meter was placed, the smallest consumption in any one month was 44,250 gallons, and the greatest 395,250 gallons, the average being 185,800 gallons per month.

Two other houses with one family and roomers in each, with a small shop in rear, the houses containing two sinks and one closet each, and one hydrant in shop. The estimated rate on the whole being $14.00. One meter covers all. The consumption last year was 1,265,250 gallons, for which the owner paid $35.64. The smallest consumption in any one month was 15,750 gallons and the greatest 317,250 gallons, average for each month 105,800 gallons.

While the properties were metered at the request of their respective owners in order to get lower rates, yet the waste has been so great that it far exceeds the estimated rate. The premises being occupied by tenants, the owners cannot prevail upon them to stop the waste, and were it not for the meters they would undoubtedly use up to the full capacity of the service pipes, unless some person stood guard over them all the time.

We have a metered consumer who calls the meter "a robber and a pirate," as it has made him pay $20.42 during the past fifteen months for which he would have only paid $8.00 had he remained upon the assessment roll. As he requested the meter placed upon his premises, he now insists on having it removed, and will not be satisfied at being placed on the assessment roll at an estimated rate of $3.60 per year, but says "the meter must come out." It still remains, however, and just what steps, if any, will be taken to remove it, he does not say. If he continues to use $20 worth of water, for which he will pay by estimated rate $3.60, he certainly cannot charge the *meter* with piracy.

These are not the only cases of the kind by any means; there are very many—probably not quite so pronounced—but yet large enough to show the great waste which is going on, even on metered premises. What it would be without the meter we can only surmise. The fact that there are a large number of such places not metered, will partially account for the works still pumping 125 gallons per capita.

While our leak examiners find the water running in many places—with every evidence of it being deliberate—yet the occupant claims it to be accidental and shuts it off, but in nine cases out of ten it is turned on again as soon as the inspector is out of sight. In such cases there is no other practical way to stop the waste other than metering the premises.

We will undoubtedly meet with some opposition in collecting the excess over the estimated rate, but as that is a bridge we have not reached as yet, I presume there will be a way provided to cross it when we arrive at that point.

As there are various opinions in regard to the cost of reading and repairing meters, delivering bills, etc., it may not be out of place to give—what seems to me from our past experience—a fair estimate of the cost of such work.

Of course, the more meters there are in service the less the average cost per meter will be. We have at the present time nearly 5,400 meters, and I estimate the yearly cost of superintendence, labor, material for repairs, reading, collecting rates, stationery, etc., at $6,650, thus making the average cost per meter one dollar and twenty-three cents ($1.23).

This estimate is based on a quarterly collection. Had we continued collecting monthly, it would add about fifty cents more per meter.

I think this estimate a liberal one, being above rather than below what the actual cost will be.

The cost of caring for meters, both for large and small consumers is about the same.

As to the life of a meter, they are so constructed, each part being interchangeable, that the repairs mentioned will keep them renewed to such an extent that their life will be almost unlimited. While in the past we have deducted 10 per cent for depreciation in value, I am convinced that it is far too much, the cost of repairing during the past year being less than one and one-half per cent.

Inspection.

The leak examiners during the past year reported 65,505 examinations, with 3,196 leaks, 2,853 of which were repaired after the notice was given, and 343 were ordered shut off for failure to make repairs.

The percentage of leaks to number of examinations is 4.78, as against 5.28 in 1896, and 8.02 in 1895, which indicates a gradual decrease in the number of leaks throughout the city.

The fact that our inspectors make a semi-annual examination of each service connection in the city, causes the consumer to pay more attention to waste through leakage than was formerly the case when no regular examinations were made. At present when a leak occurs they do not wait until it is accidentally discovered, but knowing that the inspector is liable to call at any time, proceed to have it repaired without waiting for a peremptory notice.

This department has been consolidated with the plumbing inspection, wherein the city is divided into thirteen districts, each district to have an inspector who will attend to all outside work; that is, examining for leaks, inspect plumbing, shutting off for vacancy and nonpayment, locating stop-boxes, reading meters, etc. When this system is thoroughly inaugurated, we hope to produce very satisfactory results.

Service Connections.

Sixteen hundred and eighty-seven (1,687) service connections were made during the past year, 749 were ⅝-inch, 908 1-inch, 16 2-inch, 10 3-inch, 1 4-inch, and 3 6-inch. Forty-three ⅝-inch, and 15 1-inch service connections were discontinued, making the total number of service connections in the city, on the 1st day of January, 1898, 52,219.

We also inserted, for the village of Highland Park, 12 ⅝-inch, 18 1-inch, and 1 3-inch service connections, for which they paid, in addition to our regular rates, one dollar for each tap, which charge was made to cover the extra amount of travel required in reaching their village.

The Venturi meter, mentioned in the tabulated meter statement, is set at the intersection of Woodward avenue and city limits, and covers the line of pipe which supplies the village with water.

The following statement shows the receipts and disbursements in the service cocks department during the past year:

Receipts for service cocks		$4,723 50
Receipts for plumbers' licenses		598 65
Receipts for labor and material		143 91
Total receipts		$5,466 06
Total expense service cocks department	$9,041 66	
Less labor of inspectors	4,860 50	4,181 16
Balance to credit of department		*$1,284 90

Inspection of New Work.

The work in this department has been conducted the same as in former years. In addition to inspecting all new work, and keeping the record of all stop boxes, the

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*This is an increase over the previous year of $1,270.40, with 90 less connections.

inspectors do all the shutting off for non-payment and vacancy, and also let on all vacant buildings that become reoccupied, besides making numerous enquiries for the assessors, etc.

As previously stated in this report, this department has been consolidated with the leak examiners, and meter readers, and arrangements are now being completed for working under the new system.

The following table will show the greater portion of the work done by these inspectors during the past year:

INSPECTION OF NEW WORK.

INSPECTORS.	Districts.	Examined New Connections.	Examined Extensions & Fixtures.	Let on New Connections.	Notified for Building Tax.	Calls for Non-Payment.	Shut for Non-Payment.	Let on Vacancy and Re-occupied.	Shut for Vacancy and Request.	Examined for Assessors.	Meter Bills Delivered.	Totals.
John Hatzenbuhler (services discontinued)	1	325	411	161	53	2,538	89	355	398	471	1,815	6,616
Robert Pelham, Jr. (services "	2	157	441	89	36	3,247	89	329	357	844	1,106	6,695
C. K. Skinner	3	174	1,589	117	30	3,341	136	553	582	734	2,144	9,400
William Forsyth	4	114	727	120	34	2,912	79	324	411	634	2,703	8,058
Frank Clark	5	130	497	123	53	2,950	153	416	519	1,186	2,072	8,099
Michael Hart	6	148	575	109	44	2,270	194	458	573	838	1,642	6,851
John Becker	7	337	340	160	53	1,743	77	330	392	900	1,548	5,880
Adolph Jasnowski	8	302	439	243	11	1,723	116	328	165	785	1,838	5,950
Totals		1,687	5,019	1,122	314	20,724	933	3,093	3,397	6,392	14,868	57,549

Plumbers and Plumbing.

One hundred and eighteen licenses were issued to plumbers, being an increase of five over the previous year. Several applied for and were refused a license, as they could not produce the necessary certificate from the Board of Plumbing Examiners. In other words, they failed to pass a successful examination before said board, and therefore became ineligible for a license from this office, as our rules require a certificate from the Health Board (under whom are the Board of Plumbing Examiners) before granting a license.

Our inspectors must be continually on the alert in order to prevent work being done by plumbers (or those who call themselves such) and who have no license.

Several times during the year we have had complaints from licensed plumbers that such parties were doing work, and in all cases where we have found such to be a fact we have compelled the owner to have it taken out, and employ a licensed plumber to do the work in accordance with the rules governing plumbing.

Many have an idea, however, that they have a perfect right to do plumbing, and use any kind of material on their own premises, claiming that the Board of Water Commissioners have no jurisdiction inside of the lot line; but if such were a fact, inspection would be of very little use, as nearly all plumbing is inside of the stop box, or lot line.

TABLE showing the number of taps made, and the different sizes, in each ward during the year 1897; also those discontinued.

INSERTED.	WARDS.																	Total.
SIZES.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
⅝-inch	42	2	28	11	28	25	7	39	24	29	24	52	67	57	143	118	53	749
1-inch	87	49	51	51	7	50	5	113	20	26	14	39	16	27	250	92	11	908
2-inch	3	4	2	...	1	2	...	1	...	1	...	...	...	1	1	...	...	16
3-inch	1	4	1	...	...	1	...	1	1	...	...	...	...	1	...	..	...	10
4-inch	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1
6-inch	1	2	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	3
Aggregate	134	61	82	62	36	78	12	154	45	56	38	91	83	86	394	210	65	1,687
DISCONTINUED.																		
⅝-inch	7	...	6	5	...	...	1	1	4	3	1	2	5	5	1	2	...	43
1-inch	3	10	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	15
Aggregate	10	10	6	5	...	...	2	1	4	3	1	2	5	5	2	2	...	58

INSERTED FOR VILLAGE OF HIGHLAND PARK.

⅝-inch	12	12
1-inch	18	18
3-inch	1	1
Aggregate	31	31

TABLE SHOWING THE NUMBER OF SERVICE CONNECTIONS IN USE JANUARY 1st, 1898.

Size of Connection.	No. in Use Jan. 1, 1897.	Added in 1897.	Discontinued in 1897.	Total in Use Jan. 1, 1898.
¾ inch	37,638	749	43	38,344
1 "	12,470	908	15	13,363
2 "	227	16	....	243
3 "	141	10	....	151
4 "	102	1	....	103
6 "	11	3	....	14
8 "	....	....	....	....
10 "	1	....	....	1
	50,590	1,687	58	52,219

Repairing Leaks.

No very serious leaks occurred during the past year; we had two 24-inch mains broken, but they were discovered and repaired before any damage was done other than slight injury to the pavement. In addition to the above, one 3-inch, four 4-inch, and one 6-inch were broken, with about the same results, so far as any damage was concerned.

Leaking joints in main pipes were found in one 3-inch, nine 4-inch, seven 6-inch, two 8-inch, three 24-inch, two 30-inch, and one 42-inch, making a total of 25 leaking joints, and 8 broken pipes, during the year. A record that seems to speak well for a plant containing a pipeage of 526 miles.

Twenty-one gates were repaired by this department, and 79 wood blow-off extensions were replaced with iron ones.

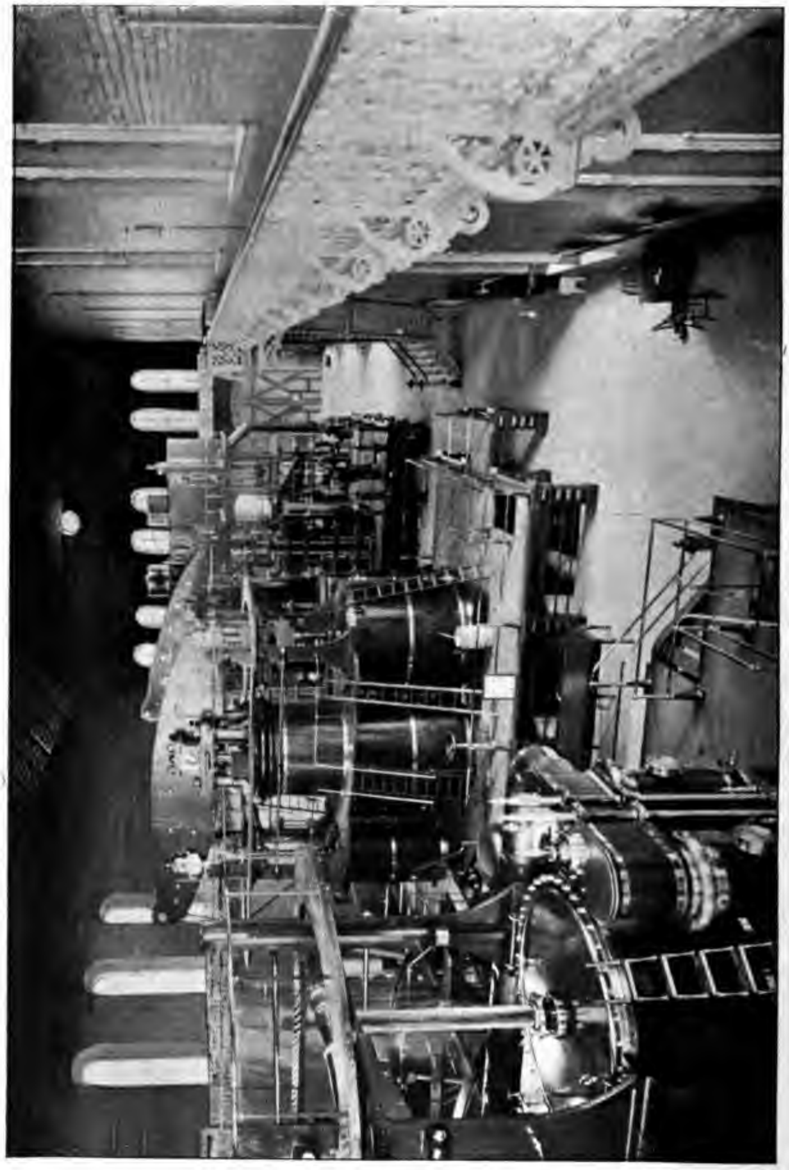
Two hundred and ninety-two (292) permits, from the Board of Public Works, were taken out to excavate in streets and alleys for the purpose of locating leaks. One was for asphalt pavement, 10 for brick, 51 for stone, and 66 for wood, while 164 were in streets and alleys that were not paved. Fifty-nine (59) permits were for leaks that proved to be on private connections, and which were turned over to the owner of property and our permit cancelled by said board, thus relieving us from any responsibility for the repairs to pavements, etc.

One hundred twelve dollars and twenty-one cents ($112.21) were paid the before-mentioned board for repairing pavements for this department during the year.

The following table is an itemized statement of a large portion of the work done during the past year:

STATEMENT OF LEAKS, COMPLAINTS, ETC., FOR THE YEAR 1897.

MONTHS.	LEAKS.				COMPLAINTS.				SHUT.				LET ON.				GATES.			Blow-Offs Opened.	Pipes Frozen.	Service Pipes Discontinued.	Service Cocks Replaced.	Stop-Boxes Located.	Blow-Offs Out of Order.	Put in New Blow-off Uprights.	Boxes Set to Grade.
	In Mains.	In Gates.	In Service Pipes.	False Reports.	No Water.	Bad Water.	Short Supply.	Water Running.	Vacant.	Non-Payment.	For Leak.	Miscellaneous.	Vacant Re-occupied.	Non Payment.	New.	Miscellaneous.	Opened.	Shut.	Found out of Order.								
January	3	2	51	14	12	6	4	7	32	5	71	4	16	44	..	16	31	31	1	629	15	6	1	..	5	..	..
February	1	2	101	5	11	3	1	3	17	4	37	4	29	40	4	9	15	15	..	250	8	..	2	2	..	4	..
March	1	1	113	17	7	9	1	3	10	5	55	9	33	18	1	17	15	15	..	690	3	1	..	2	1	6	..
April	2	2	125	8	18	6	5	1	25	11	29	16	47	104	5	25	27	27	1	682	..	..	..	1	..	9	..
May	5	..	125	14	8	4	15	1	16	13	37	5	21	89	6	13	24	24	..	667	..	3	2	2	..	1	..
June	4	9	144	18	8	12	5	2	25	2	45	4	19	39	..	24	68	68	2	621	..	3	4	8	..	4	5
July	5	10	114	27	17	37	19	10	43	6	41	8	38	125	4	19	102	102	8	707	..	3	..	1	..	2	9
August	1	4	119	17	11	39	5	4	20	9	47	10	49	119	2	12	124	124	8	730	..	6	2	3	1	15	3
September	5	8	106	27	12	18	19	6	18	4	36	8	26	29	3	9	65	65	2	736	..	4	3	4	..	12	..
October	..	7	100	22	14	12	5	6	33	13	37	18	18	74	1	13	102	102	1	730	..	3	13	3	..	5	27
November	5	..	119	13	11	8	2	4	36	4	57	10	22	48	4	9	58	58	1	707	..	8	4	3	1	5	12
December	1	3	105	9	9	4	3	5	37	8	38	12	17	12	1	14	33	33	..	710	8	5	2	7	..	7	..
Totals for 1897	33	48	1,322	191	138	158	84	52	312	79	545	108	335	736	31	180	664	664	14	7,877	29	42	33	36	8	70	56
Totals for 1896	56	66	1,004	..	167	98	77	79	277	53	601	109	341	880	37	186	393	396	12	4,891	33	62	26	22	..	..	..
Totals for 1895	88	55	1,379	..	345	83	103	80	109	41	902	50	455	886	78	42	352	352	48	2,003	120	43	13	18	..	..	..



REPORT OF CHIEF ENGINEER AT PUMPING WORKS.

Detroit, January 1, 1898.

To the Board of Water Commissioners:

Gentlemen—I have the honor to submit the Engineer's **report for the year** 1897.

The following table shows the number of gallons of water **pumped, and cost** of fuel for the years named:

YEAR.	Gallons of Water Pumped.	Cost of Fuel Consumed	Average Daily Delivered.
1852	235,840,271	....	646,411
1853	303,531,748	$2,129 87	931,594
1854	376,265.126	2,271 84	1,030,866
1855	542,807,364	3,325 81	1,487,143
1856	692,124,305	4,017 44	1,896,231
1857	697,190,523	3,993 20	1,909,837
1858	718,091,207	3,655 20	1,967,378
1859	782,112,587	3,194 15	2,142,774
1860	870,036,451	4,196 21	2,383,580
1861	895,129,423	4,414 07	2,452,409
1862	994.945.829	3.150 95	2,725,878
1863	1,035,798,043	4,670 86	2,837,808
1864	1,018,390.256	7,647 62	2,839,078
1865	1,049.514.887	7,372 89	2.875,383
1866	1,196,317,922	9,849 16	3,277,583
1867	1,425.535,230	10,121 82	3,905,576
1868	1,666,546.125	11,879 23	4,507,248
1869	1,946,810,825	11,247 92	4,511,809
1870	1,866,060,068	12,713 78	5.112,493
1871	2,300,150,605	14,681 05	6,301,782
1872	2,782,292,578	17.736 86	7,601,892
1873	3,198,893,948	20,233 30	8,762,723
1874	3,289,872,635	20,431 71	9,013,850
1875	4,207,454,260	21,398 98	11,527,272
1876	4,065,134,470	19,832 89	11,107,499
1877	4,213,239,790	17,433 72	11,543,123
1878	4,345.743,330	10,943 82	11,906,146
1879	5,129,599,110	11,219 51	14,053,696
1880	5,552,965,310	12,276 60	15,172,036
1881	6,543,127,968	16,556 63	17,926,877
1882	6,284,000,742	13,156 16	17,261,440
1883	7,379,327,188	16,495 99	20,217,334
1884	8,510,614,140	19,877 07	23,253,044
1885	9,970,829,580	21,341 48	27,317,341
1886	10,576,571,254	20,887 24	28,976,907
1887	13,168,859,808	35,882 83	36,079,166
1888	14,380,166,670	39,568 66	39,397,716
1889	12,875,334,453	34,413 31	35,274,888
1890	12,120,944,532	31,852 40	33,209,067
1891	12,057,261,236	33,826 86	33,033,592
1892	12,476,612,482	31,034 40	34,182,499
1893	13,877,977,208	27,479 93	38,021,855
1894	13,649,779,605	29,283 47	37,396.656
1895	14,608,451,954	32,095 00	40,269,731
1896	13,254,369,371	31,186 17	36,215,123
1897	12,928,821,326	17,355 58	35,421,428

The following tables show in detail the work done by each engine each month of the year:

ENGINE No. 1.

MONTHS.	Time run.		Revolutions.	Gallons Water.
	H.	M.		
January	437	20	258,217	252,793,362
February	11	....	6,125	4,814,250
March	676	50	389,723	446,292,534
April	720	....	413,005	481,270,080
May	360	....	209,643	246,304,254
June	407	55	233,633	281,884,008
July	95	....	58,042	55,389,852
August	291	45	168,725	212,927,316
September	248	....	148,491	195,026,952
October	314	50	183,882	218,201,412
November	494	25	281,800	323,757,170
December	744	....	441,720	557,008,620
Total	4,801	05	2,793,006	3,275,669,810

ENGINE No. 2.

January	705	50	443,467	695,071,392
February	672	....	434,550	549,424,800
March	216	....	135,138	207,354,384
April	24	....	11,513	18,512,904
May	380	45	233,001	279,415,728
June	51	....	30,604	42,460,224
July	542	05	342,029	479,291,088
August	265	15	165,110	220,519,200
September	236	35	148,365	196,609,968
October	633	30	395,660	608,932,920
November	337	50	207,616	293,810,928
December	......	....	....	....
Total	4,064	50	2,547,053	3,591,403,536

ENGINE No. 3.

January	124	....	73,680	132,624,000
February	......	....	....	....
March	......	....	....	....
April	......	....	....	....
May	......	....	....	....
June	720	....	406,344	731,419,200
July	714	....	484,270	781,686,000
August	688	30	401,062	721,911,600
September	720	....	428.730	771,714,000
October	264	....	157,805	284,049,000
November	......	....	....	....
December	......	....	....	....
Total	3,230	30	1,901,891	3,423,403,800

ENGINE No. 4.

January	100	10	88,464	69,444,240
February	672	...	590 250	463,346,250
March	575	45	505,564	396,867,740
April	694	20	552,110	433,406,350
May	741	05	579,830	455,166,550
June	......	....	....	....
July	......	....	....	....
August	......	....	....	....
September	......	....	....	....
October	......	....	....	....
November	524	30	418,070	328,184,950
December	744	....	626,660	491,928,100
Total	4,051	50	3,360,948	2,638,344,180

Fuel, coal consumed	$17,355 58
Salaries, engineers and firemen	19,603 30
Engine oil and waste	391 28
Repairs, boilers and machinery	329 00
Supplies, soap, polish, etc	81 03
Supplies, valves, gaskets, packing, etc	90 26
Electric light supplies, etc	76 99
Farrier	6 00
Horse expense	142 30
Boiler inspection	24 00
Stationery	1 70
Ice	12 55
Street cars and telegrams	10 00
Total	$38,123 99

The cost of fuel, per million gallons pumped, has been $1.34, and per million gallons pumped 100 feet high, $1.24.

Engines Nos. 1 and 2 were run a good part of the year with pumps single acting.

The table shows that the water pumped during the year was 12,928,821,326 gallons, a decrease compared with 1896 of 325,548,045 gallons.

The total expense for pumping water was $38,123.99, making the cost per million gallons $2.94, a decrease compared with last year of $1.08.

It is very gratifying to be able to note that the fuel expense for pumping water in 1897 is 12¾ per cent less than it was in 1884, while in 1897 we pumped 52 per cent more water.

The expense at the pumping station for 1897 was $15,255.07 less than for the year 1896, a showing that must be gratifying to all concerned.

Engines Nos. 1, 2 and 4 are in good condition.

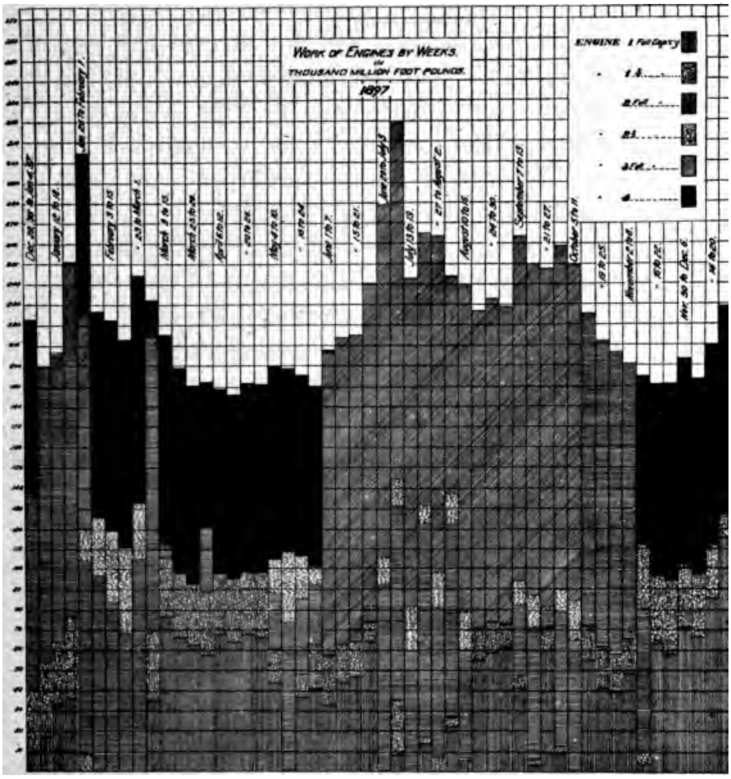
Engine No. 3, which has been disabled a number of times in former years, has come in for its turn for improvement which I recommended January last. Although the alterations have not yet been completed, I expect that we will be able to pump water, if necessary, about the 25th of January, and expect the work to be fully completed by February 15th. When finished, the weak parts will be greatly improved.

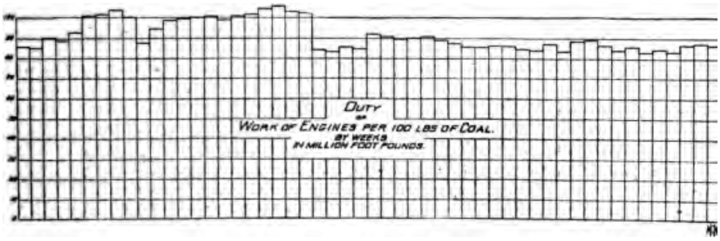
The most important change we have made was to remove the 46-inch H. P. cylinder and replace it with one of 35-inch, and intend to increase the steam pressure to 120 pounds per square inch.

By reducing the H. P. cylinder it allowed us to shorten up the main beam pin 18 inches; also the cross head 15 inches. The engine has had three of each since it was built. These changes will not only strengthen the engine but will also increase its efficiency.

Plate IV., page 81, shows a sectional elevation of the work in foot pounds done weekly by each engine under the different conditions of working, and also the foot pounds of work per ten pounds of coal for the same period done by the station as a whole. This shows the station duty to have averaged above 100,000,000 foot pounds per 100 pounds of coal for several weeks while burning Pocahontas coal. It also shows the gain per pound in burning Pocahontas over that purchased under the last contract. Comparing the period from March 9 to April 20 with that from November 9 to December 20, the same engines running on both occasions, and approximately the same quantity of work being done daily by each, the temperature being nearly the same in the two periods, we see that the Pocahontas coal in the first period gave an average station duty of over 100,000,000 foot pounds per 100 pounds, while the other coal in the latter period gave only 85,000,000 foot pounds or 15 per cent less. At the price heretofore paid the former coal would cost $2.63½ and the latter $2.37 per ton in the sheds, or the former costs 11.2 per cent more than the latter. At these prices it is a 3¾ per cent better investment to buy Pocahontas on the showing of this chart,

Plate VI


WORK OF ENGINES BY WEEKS.
IN
THOUSAND MILLION FOOT POUNDS.
1897
ENGINE 1 Full Capacity
" 1 A.
2 Full
" 2 A.
" 3 Full
" 4
Dec. 28, '96 to Jan. 4, '97.
January 12 to 18.
Jan. 26 to February 1.
February 9 to 15.
" 23 to March 1.
March 9 to 15.
March 23 to 29.
April 6 to 12.
" 20 to 26.
May 4 to 10.
" 18 to 24.
June 1 to 7.
" 15 to 21.
June 29 to July 5.
July 13 to 19.
" 27 to August 2.
August 10 to 16.
" 24 to 30.
September 7 to 13.
" 21 to 27.
October 5 to 11.
" 19 to 25.
November 2 to 8.
" 16 to 22.
Nov. 30 to Dec. 6.
" 14 to 20.


DUTY
OR
WORK OF ENGINES PER 100 LBS OF COAL.
BY WEEKS
IN MILLION FOOT POUNDS.

aside from the advantage due the former in degree of smokelessness. The station duty here given includes all fuel used for heating engine house, greenhouse and engineer's dwelling, but is corrected for lighting. This chart also shows that the last lot of coal received was considerably inferior to that furnished on the same contract in July.

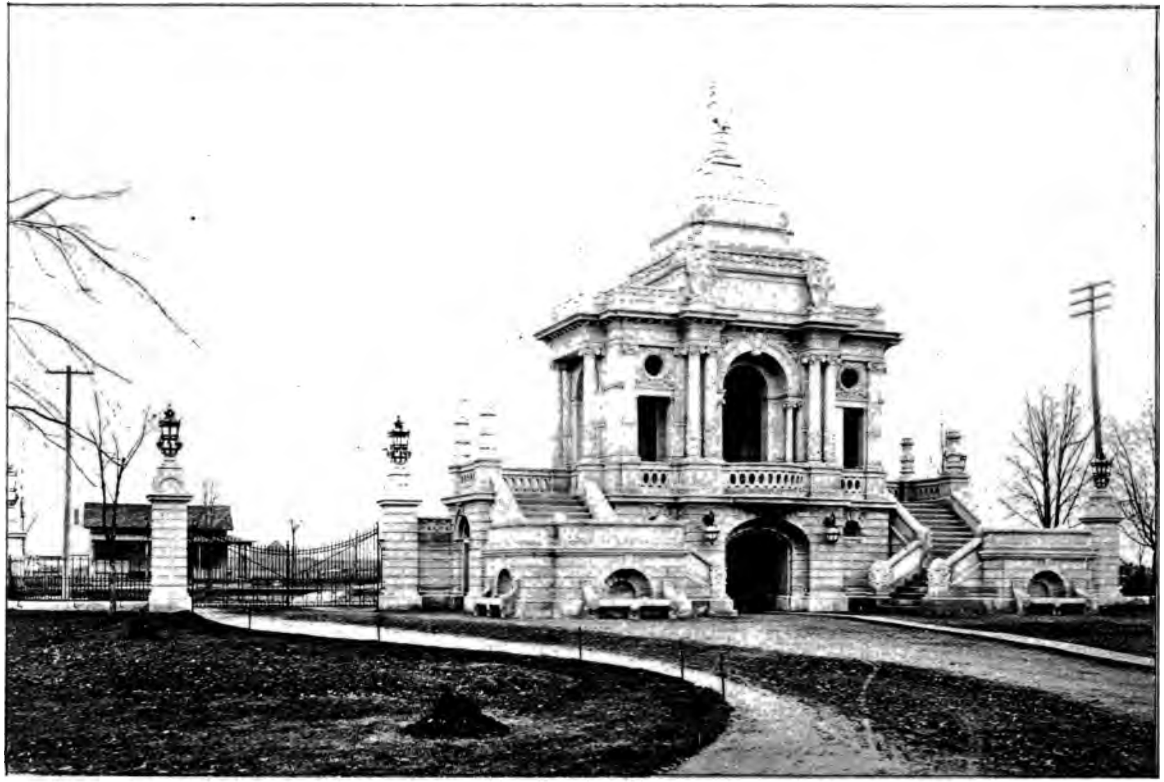
The boilers in the west and middle rooms are in good condition. Those in the east room are also in good condition, considering their age.

The furnaces which were tested last June still remain in the same condition as when tested. It would add greatly to the appearance of the boiler room and also abate the smoke nuisance if all the boilers were uniformly equipped with the devices selected from that test.

The engine house and coal sheds are in a fair condition.

Respectfully submitted,

URIAH GOULD
Chief Engineer at Pumping Works.



THE HURLBUT MEMORIAL GATEWAY.

VALUATION OF THE WORKS.

AGGREGATES.

Real estate	$ 418,450 00
Oil plant (10 per cent off from last year)	11,766 00
Buildings, docks, basins, conduits, force mains and engines at works	1,269,598 00
Water pipe laid and in use	3,636,733 83
Meters placed and in use	100,750 27
Horses, vehicles, harnesses, etc. (18 horses)	4,405 15
Furniture, etc., iron pipe office	572 86
Office furniture and fixtures	6,108 00
Materials and tools for repairs at office	388 93
Materials, including iron pipe storage yard	34,740 64
Materials, meter department	1,895 89
Materials, service cocks	2,372 15
Materials, pumping water department	21,947 20
Materials, pumping works department	1,163 53
	$5,510,892 45

VALUE OF REAL ESTATE.

Office building and lot	$ 60,000 00
Orleans street lots	30,000 00
Storage grounds and improvements	53,450 00
Pumping works grounds and improvements	275,000 00
	$ 418,450 00

VALUE OF HORSES, VEHICLES, HARNESSES, ETC.

Pumping water, 1 horse, vehicle and harness	$ 230 00
Storage yard, 12 horses, vehicles and harnesses	3,221 65
Superintendent, 1 horse, carriage and harness	300 00
John Wallace, 1 horse, carriage and harness	75 00
Repairing leaks, 1 horse, wagon and harness	103 50
Meter, 1 horse, wagon and harness	285 00
Pumping works, 1 horse, wagon and harness	190 00
	$ 4,405 15

Attached to this report is a complete list of tools on hand and an itemized account of material in stock in the meter, service cocks, and repairing leaks departments, on the 31st day of December, 1897.

All of which is respectfully submitted.

T. R. PUTNAM,
Supt. Meters and Inspection.

SUPPLEMENT.

BOARD OF MANAGEMENT OF DETROIT WATER WORKS.

Board of Trustees appointed by Common Council, February 24th, 1852; organized March 1st, 1852.

Shubael Conant, Chairman. Edmund A. Brush.
Henry Ledyard. Wm. R. Noyes.
Jas. A. Van Dyke.

1853.

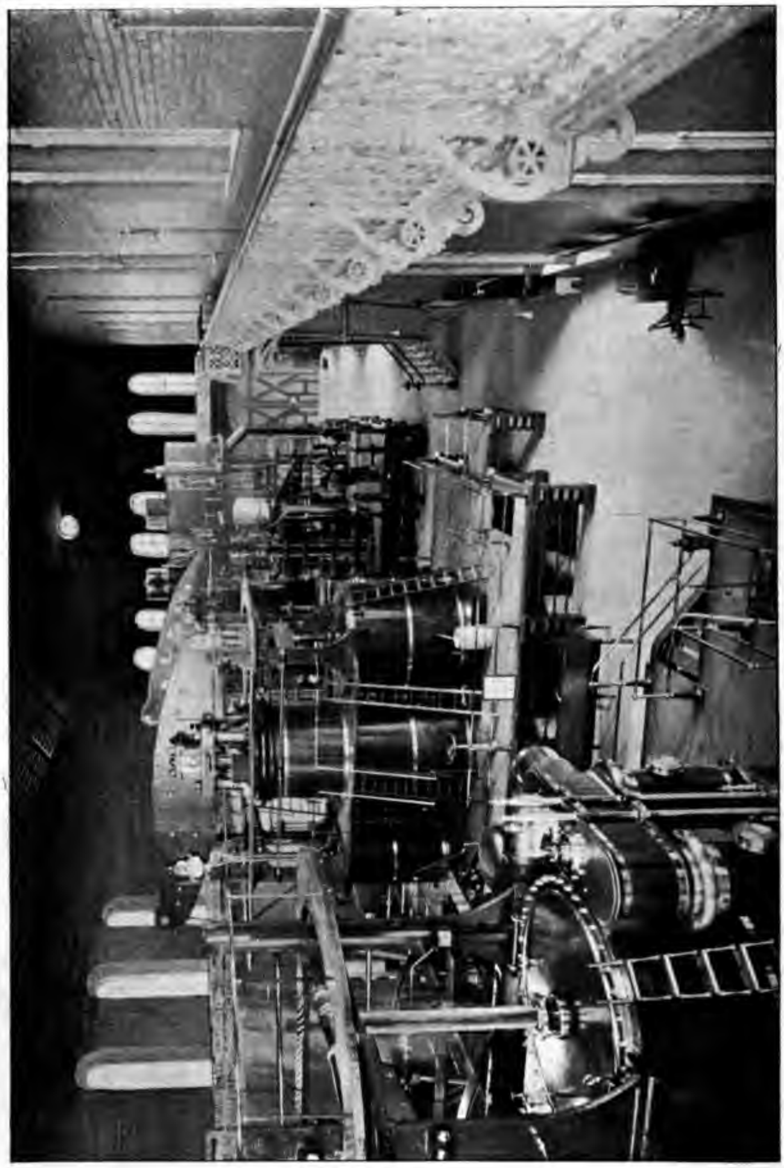
On the 16th of May, 1853, the Board of Water Commissioners of the City of Detroit was organized under an act previously approved by the Common Council and passed by the Legislature, February 14th, 1853. The term of service was determined by lot, as follows:

Jas. A. Van Dyke,	for 3 years.
Edmund A. Brush,	for 4 years.
Henry Ledyard,	for 5 years.
Shubael Conant,	for 6 years.
Wm. R. Noyes,	for 7 years.

Shubael Conant was elected President, who, finding the duties too arduous, resigned July 30th, and Edmund A. Brush was elected.

1854.

Edmund A. Brush, President. Jas. A. Van Dyke.
Shubael Conant. Wm. R. Noyes.
Henry Ledyard.



REPORT OF CHIEF ENGINEER AT PUMPING WORKS.

Detroit, January 1, 1898.

To the Board of Water Commissioners:

Gentlemen—I have the honor to submit the Engineer's report for the year 1897.

The following table shows the number of gallons of water pumped, and cost of fuel for the years named:

YEAR.	GALLONS OF WATER PUMPED.	COST OF FUEL CONSUMED.	AVERAGE DAILY DELIVERED.
1852	235,840,271		646,411
1853	303,531,748	$2,129 87	931,594
1854	376,265,126	2,271 84	1,030,866
1855	542,807,364	3,325 81	1,487,143
1856	692,124,305	4,017 44	1,896,231
1857	697,190,523	3,993 20	1,909,837
1858	718,091,207	3,655 20	1,967,378
1859	782,112,587	3,194 15	2,142,774
1860	870,036,451	4.196 21	2,383,580
1861	895,129,423	4,414 07	2,452,409
1862	994,945,829	3.150 95	2,725,878
1863	1,035,798,043	4,670 86	2,837,808
1864	1,018,390,256	7,647 62	2,839,078
1865	1,049,514,887	7,372 89	2,875,383
1866	1,196,317,922	9,349 16	3,277,583
1867	1,425,535,230	10,121 82	3,905,576
1868	1,666,545,125	11,379 23	4,507,248
1869	1,946,810,325	11,247 92	4,511,809
1870	1,866,060,068	12,713 78	5,112,493
1871	2,300,150,605	14,681 05	6,301,782
1872	2,782,292,578	17,736 86	7,601,892
1873	3,198,393,948	20,233 30	8,762,723
1874	3,289,872,635	20,431 71	9,013,850
1875	4,207,454,260	21,393 98	11,527,272
1876	4,065,134,470	19,832 89	11,107,499
1877	4,213,239,790	17,433 72	11,543,123
1878	4,345,743,330	10,943 82	11,906,146
1879	5,129,599,110	11,219 51	14,053,696
1880	5,552,965,310	12,276 60	15,172,036
1881	6,543,127,968	16,556 63	17,926,877
1882	6,284,000,742	13,156 16	17,261,440
1883	7,379,327,188	16,495 99	20,217,334
1884	8,510,614,140	19,877 07	23,253,044
1885	9,970,829,580	21,341 48	27,317,341
1886	10,576,571,254	20,387 24	28,976,907
1887	13,168,859,808	35,882 83	36,079,166
1888	14,380,166,670	39,568 66	39,397,716
1889	12,875,334,453	34,413 31	35,274,888
1890	12,120,944,532	31,852 40	33,209,067
1891	12,057,261,236	33,826 86	33,033,592
1892	12,476,612,482	31,034 40	34,182,499
1893	13,877,977,208	27,479 93	38,021,855
1894	13,649,779,605	29,283 47	37,396.656
1895	14,698,451,954	32,095 00	40,269,731
1896	13,254,369,371	31,186 17	36,215,123
1897	12,928,821,326	17,355 58	35,421,428

1867.

Edmund A. Brush, President, re-appointed May 1, for 5 years.
Alexander D. Fraser.
Jacob S. Farrand.
Jno. Owen.
Stanley G. Wight.

1868.

*Edmund A. Brush, President.
Stanley G. Wight, term expired May 1, and
Chauncey Hurlbut appointed for 5 years.
Jacob S. Farrand.
John Owen.
Caleb Van Husan.

*Edmund A. Brush resigned January 28, and Caleb Van Husan appointed to fill vacancy, and Alexander D. Fraser elected President.

1869.

Alexander D. Fraser, President.
John Owen, re-appointed May 1, for 5 years.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.

1870.

Alex. D. Fraser, President.
Jacob S. Farrand, re-appointed May 1, for 5 years.
Jno. Owen.
Caleb Van Husan.
Chauncey Hurlbut.

1871.

*Alex. D. Fraser, President.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.
John Owen.

*Term expired May 1, and Samuel F. Hodge appointed for 5 years. Jacob S. Farrand elected President.

1872.

Jacob S. Farrand, President.
Jno. Owen.
*Caleb Van Husan.
Samuel F. Hodge.
Chauncey Hurlbut.

*Term expired May 1st, and Elija Smith appointed for 5 years.

1873.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed. Elected President, May, 1872.

1874.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re.appointed.

1875.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1876.

Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. *Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1877.

Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
*Michael Martz.

*Elija Smith's term expired and Michael Martz appointed to fill vacancy.

1878.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Michael Martz.

*Term expired and re-appointed.

1879.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
*Jno. Pridgeon.

*Jno. Owen's term expired and John Pridgeon appointed to fill vacancy. Samuel F. Hodge resigned and Jas. Beatty appointed to fill vacancy.

1880.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1881.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1882.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1883.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1884.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
*Jno. Pridgeon.

*Term expired, and Marshall H. Godfrey appointed.

1885.

*Jacob S. Farrand, President. Michael Martz.
Marshall H. Godfrey. *Edwin F. Conely.
*Samuel G. Caskey.

*Jas. Beatty died and Edwin F. Conely appointed to fill vacancy.
*Chauncey Hurlbut died and Samuel G. Caskey appointed to fill vacancy.
*Jacob S. Farrand's term expired and re-appointed.

1886.

Jacob S. Farrand, President. Michael Martz.
Marshall H. Godfrey. *Jno. Pridgeon.
Samuel G. Caskey.

*Edwin F. Conely's term expired and Jno. Pridgeon appointed to fill vacancy.

1887.

Jacob S. Farrand, President. Jno. Pridgeon.
Marshall H. Godfrey. Samuel G. Caskey.
*Joseph Nagel.

*Michael Martz term expired and Joseph Nagel appointed to fill vacancy.

1888.

Jacob S. Farrand, President. Jno. Pridgeon.
Marshall H. Godfrey. *Samuel G. Caskey.
Joseph Nagel.

*Term expired and re-appointed.

1889.

Jacob S. Farrand, President. Jno. Pridgeon.
Samuel G. Caskey. Jos. Nagel.
*August Goebel.

*Marshall H. Godfrey resigned January 1, 1889. August Goebel appointed to fil vacancy. Term expired May 1st, and re-appointed.

1890.

Jno. Pridgeon, President.	August Goebel.
Joseph Nagel.	*Henry M. Duffield.
Samuel G. Caskey.	

*Jacob S. Farrand's term expired, and Col. Duffield was appointed to fill vacancy July 9th, 1890; John Pridgeon resigned as President of the Board, on account of ill-health, and Henry M. Duffield was elected to fill vacancy.

1891.

Henry M. Duffield, President.	*Jno. Pridgeon.
August Goebel.	Samuel G. Caskey.
Joseph L. Hudson.	

*John Pridgeon's term expired May 1st, and Frank E. Kirby was appointed for a term of 5 years.

1892.

Samuel G. Caskey, President.	Henry M. Duffield.
August Goebel.	Joseph L. Hudson.
Frank E. Kirby.	

1893.

August Goebel, President.	Samuel G. Caskey.
Frank E. Kirby.	Henry M. Duffield.
Joseph L. Hudson.	

1894.

Henry M. Duffield, President.	Frank E. Kirby.
Albert L. Stephens.	De Witt H. Moreland.
Edward W. Pendleton.	

A. L. Stephens appointed to succeed J. L. Hudson.
D. W. H. Moreland appointed to succeed S. G. Caskey.
Clarence A. Black appointed to succeed August Goebel.
C. A. Black resigned and E. W. Pendleton appointed to succeed him from Dec, 1.

1895.

Frank E. Kirby, President.	Albert L. Stephens.
DeWitt H. Moreland.	Edward W. Pendleton.
Darius D. Thorp.	

1896.

Albert L. Stephens, President.
Edward W. Pendleton.
John P. Huckestein.
Darius D. Thorp.
John W. McGrath.

D. W. H. Moreland resigned to accept Commissionership on Board of Public Works, and J. P. Huckestein was appointed to fill vacancy.

Frank E. Kirby's term expired and J. W. McGrath was appointed to succeed him

1897.

Edward W. Pendleton, President.
Darius D. Thorp.
James W. Millen.
John W. McGrath.
August Goebel.

August Goebel, appointed to succeed A. L. Stephens. Resigned January 1, 1898, and Joseph J. Noeker was appointed to fill vacancy.

John P. Huckestein resigned and James W. Millen was appointed to fill vacancy.

REPORT OF COMPETITIVE TRIALS

BETWEEN A MURPHY MECHANICAL STOKER AND A HAWLEY DOWN DRAFT FURNACE AT THE DETROIT WATER WORKS, JUNE, 1897,

BY GEO. H. BARRUS,

Office of Geo. H. Barrus,
95 Milk St., Boston.

Boston, July 31, 1897.

Board of Water Commissioners,
Detroit, Mich.

Gentlemen:—

In accordance with the requests and instructions contained in your letters of March 29th, April 3d, June 1st and June 3d, 1897, and in accordance with a vote of the Board of Commissioners on January 30th, 1896, and with votes of the Board on June 11th, 1897, I have conducted a series of smoke observations and evaporative trials on two of the wood water-tube boilers at your pumping station, one of which is fitted with the Murphy Mechanical Stoker and the other with the Hawley Down Draft Furnace; and I submit in the following pages a full report of the same, together with my conclusions.

Stated briefly, my conclusions as to the relative efficiency of the two furnaces in the prevention of smoke and in fuel economy are as follows:

1. When using Pocahontas coal, the Murphy furnace was practically smokeless. When using Hocking slack and Bellmore pea coal, the quantity of smoke produced by the Murphy furnace was insignificant. When using

Jackson nut and slack coal, there were periods when the Murphy furnace was smokeless, but at other times it emitted a large quantity of smoke. When Pocahontas coal was used, the Hawley furnace frequently emitted a varying amount of light smoke. This occurred after the fires were disturbed or fresh coal was added, and lasted from fifteen seconds to three minutes. When the other three coals were used, the quantity of smoke produced by the Hawley furnace was greater than with the Pocahontas coal. For a part of the time when Jackson nut and slack coal was used, the Hawley furnace produced no more smoke than the Murphy stoker, but for the entire run the quantity was greater.

2. The Hawley furnace was more efficient in fuel economy than the Murphy stoker when the fuel was Pocahontas coal. The difference in favor of the Hawley furnace with this coal was 5.8 per cent, if credit is given for the coal which fell through the grates of the Murphy furnace, and 14 per cent if the comparison is based on the total coal fired. The first, applied to the cost of coal for a year's run of the pumping station (taken at an evaporation of 125,000,000 pounds of water) represents an annual difference of $850, and the second an annual difference of $2,325, in favor of the Hawley furnace.

With the three remaining coals, the Murphy stoker operated with greater fuel economy than the Hawley furnace, the difference varying from 5.6 per cent to 10.5 per cent, corresponding to a yearly saving of $850 and $1,787 respectively. In point of cost, none of these coals, whether burned in the Murphy or in the Hawley furnace, gave so good results as the Pocahontas coal on the test of the Hawley furnace.

I am, faithfully yours,

GEO. H. BARRUS.

History of the Trials.

At a meeting of the Board of Water Commissioners, held in Detroit, January 30th, 1896, the following vote was passed in regard to equipping the four new boilers to be erected in the pumping station by Wickes Bros., of Saginaw, Mich.:

> "Resolved, That the four boilers be equipped as follows: One boiler with the Murphy stoker, one boiler with the Roney stoker, one boiler with the Hawley Down Draft furnace, and one with the rocking grates of the boiler manufacturers; that a competitive test be had six months after their completion by Geo. H. Barrus, of Boston, or some other expert agreeable to all parties, lasting six days, and that the furnace showing the greatest efficiency shall receive the contract, and that the other attachments shall be removed without expense to the board; further, that the said tests be made with different kinds of coal 'sold in the market'."

In accordance with this resolution, one of the boilers was equipped with a Murphy stoker, and one with a Hawley Down Draft furnace, contracts having been made with the Murphy Iron Works of Detroit, and the Hawley Down Draft Furnace Company of Chicago, for this purpose. The Roney stoker mentioned in the resolution was not applied.

The contract with each party contained the following stipulations:

> "The party of the first part" (referring to the furnace company) "agrees to equip one of the boilers set up by Wickes Bros., of Saginaw, at the pumping works of the party of the second part, with a .... furnace that is adapted to the boiler which is 250 H. P., and which will set 66 inches above the floor, and the party of the second part to accommodate themselves thereto."
>
> "The party of the first part further agrees to submit to the competitive test as embodied in the aforesaid resolution, and all of the provisions thereof, with the additional understanding that the test will be made, first, as to the prevention of smoke, and second, as to the evaporative efficiency in economy of the said furnaces; and also, that during the said test the boilers are to be fired by the regularly employed firemen of the board."

The two furnaces were completed and set to work the last part of November, 1896, and the six months' interval which the resolution required should elapse between the time of their completion and the time of the test, expired the last part of May, 1897. During this period the furnaces were operated exclusively with Pocahontas coal.

Active preparations were begun for the work of the tests on May 31st, 1897. On that day the writer made an external and internal examination of the two boilers, both of which were out of service. The boilers were then closed up, and the boiler to which the Murphy furnace was attached was filled with water and fired up, in order to give it a preparatory heating. This heating lasted for some 48 hours' continuous run. At the expiration of that time, a series of four evaporative trials was made with the four different kinds of coal selected for the tests. These trials, which were nominally of 24 hours' duration, were, with one exception, preceded by a preliminary trial, having for its object the instruction of the firemen in regard to the handling of the particular coal in use, and the manipulation of the automatic stoker. They were made with the boiler developing, approximately, 210 H. P. The reasons for adopting this rate instead of 250 H. P., as mentioned in the contracts, were fully explained to the board at their meeting of June 10th. During the progress of these trials, the handling of the boiler was, to a greater or less extent, under the direction of either Mr. Murphy, or some representative of the company, one of whom was in constant attendance. The coal and water weights and other data taken by the writer and his assistants during the conduct of these trials were also taken simultaneously by Mr. Gilbert Wilkes, mechanical engineer of Detroit, or by one of his assistants, who represented the Murphy Iron Works, and likewise by Mr. Blair, mechanical engineer of the Hawley Furnace Company, assisted a part of the time by Mr. Wood, Detroit representative of the Hawley Furnace Company, and by Mr. Kane, the expert fireman of the same company. During the progress of this series of tests, numerous verbal protests were made to the writer by Messrs. Murphy and Wilkes in regard to the methods employed in conducting the tests, and one written protest was submitted by the Hawley Furnace Company. At about the time of completing the same, Mr. Murphy presented a written protest to the Board of Commissioners, objecting to the conditions as to the boiler power, etc., under which the tests were being made, which led the Board, after conference with the writer and representatives of both parties, at a meeting held June 11, 1897, to pass a resolution directing that the tests should be made with the boilers developing 200 H. P. In view of this action of the Board, it became necessary to start the tests anew and abandon those which had been thus far conducted, and no further reference will be made to them.

At the suggestion of the writer, another resolution was passed at the same meeting, to the effect that during the progress of the tests, all persons should be excluded from the boiler room excepting the men regularly employed by the Board, the writer and his assistants.

The terms of the contract provide that the boilers are to be fired by the regularly employed firemen of the Board, and it is evident that the intent of this requirement was that the boilers should be operated under conditions which should approach as near as may be the working conditions of the plant. During the first tests the firemen had become familiar with the operations of the Murphy furnace with the different coals, and it seemed to be unnecessary, and undesirable in view of the terms of the contract, for them to be under the supervision of the representatives of the interested companies, after having obtained such experience.

In order that the firemen might also have some opportunity to become familiar with the working of the Hawley furnace with the different fuels, it was decided to devote two days to preliminary trials on this furnace in the presence of the expert fireman of the Hawley Company. The representatives of this company who were present expressed themselves as satisfied with the arrangement. These preliminary trials having been made, the boiler room was closed against the entrance of all parties excepting employes of the Board, the writer, and his assistants, and the formal trials were at once begun.

Previous to the beginning of the preparatory run on the Hawley furnace, the fireman employed by the Hawley Furnace Company made an examination of the setting of the boiler and removed several loads of soot and ashes which had accumulated in the smoke passages in the upper chamber. The Murphy Iron Works objected to this on the ground that the same thing had not been done on their boiler. Consequently, at the close of the tests on the Hawley furnace, and prior to the new tests on the Murphy furnace, they were allowed, by order of the Board, to clean their boiler. During the interval between the completion of the tests on the Hawley furnace and the new tests on the Murphy furnace, which was some 48 hours in duration, representatives of the Murphy Iron Works were present during the greater part of the time. During the last 24 hours of the interval they were continuously in attendance, together with Mr. Wilkes and his assistants, conducting a test of the boiler with Pocahontas coal. This was done in the writer's absence and without his consent. During the same interval, the pipe which conducts live steam to the clinker bar of the stoking apparatus was removed by Mr. Murphy and the interior was bushed so as to reduce the opening to an orifice $^5/_{32}$ inch in diameter, and limit the quantity of steam passing through as near as possible to that corresponding to an opening of one-quarter turn of the $\frac{1}{4}$-inch valve, the amount given in the "Directions for operating the furnace." This change of the stoker was made in the absence of the writer and without his permission. The bushing, however, remained during the tests.

The tests on the Hawley furnace were conducted from June 13th to June 19th, and those on the Murphy furnace from June 22d to June 29th, and during the time that the tests were actually in progress the orders of the Board in regard to excluding persons not connected with the work were rigorously enforced.

Interpretation of the Contracts.

The two contracts with the furnace companies, as the writer interprets them, contain three essential provisions.

The first is, that the furnaces should run six months prior to the competitive tests. It is evident that the intent of this requirement was, that each furnace should be subjected to a six months' period of actual service. One of these furnaces being a mechanical stoker, in which mechanism is provided for feeding the coal into the furnace and giving motion to the grates, the object of the requirement was the determination of the results, not when the apparatus was new, but after it had been subject to the wear and tear of ordinary duty.

The second requirement is, that the furnaces should be adapted to a 250 H. P. boiler. In other words, that they should have a working capacity of 250 H. P. under the conditions provided at the water works. In view of the fact that the furnaces were to be adapted to using different kinds of coal sold in the market, this requirement applies not only to one coal, but to all the coals tested. In accordance with the statement of Mr. Murphy, the agreement to adapt his furnace to a 250 H. P. boiler was not intended, the figure "250" being written in the contract by mistake. His furnace, he states, was built for a 200 H. P. boiler, this being the capacity of the boiler according to the rating of Wickes Bros., the builders. The rule of the American Society of Mechanical Engineers in regard to boiler capacity, as expressed by their committee on boiler tests, provides that a boiler should develop its rated power with easy firing, and it should be capable beyond this of developing one-third more than its rated power when crowded to its maximum capacity. Applied to this case, the furnaces should be capable, when crowded, of working to a capacity one-third more than 250 H. P., that is, to 333 H. P., under the strict terms specified in the contracts, and to one-third more than 200 H. P., that is, to 266⅔ H. P., if rated to correspond with Mr. Murphy's understanding.

The third requirement is, that the two furnaces should be subjected to a competitive test, having for its first object the determination of the relative smokelessness of the two; and for a second object, the determination of the relative economy of the two furnaces in the consumption of coal, the tests being made with the different kinds of coal sold in the market, and the firing being done by the regular firemen of the pumping station. The evident intent of the contract in these two respects is the determination of the relative efficiency of the two furnaces under conditions of the working practice of the pumping station.

Description of Plant, Dimensions, and Manner of Operation.

The two boilers on which these tests were made are of the Wood Water Tube type. They are set in one battery of brick work. The right hand boiler is equipped with the Murphy furnace, while the left hand one is set with the Hawley furnace. By reference to the accompanying Sketch No. 1, which shows a plan of the boiler house, the general location of the boilers in the building will be seen. The boilers receive their draft from a horizontal iron flue, extending along the front overhead, and connecting the two chimneys of the pumping station together. By the use of dampers which are provided, the boilers can be connected to either chimney, as desired. On all the tests here reported, the left hand chimney, the one to the west, was used, the other boilers of the station which were in operation at the time, being connected to the east chimney. There are also connected to the west chimney the other two Wood boilers; and the plant of four horizontal tubular boilers, though none of these were in operation during any of the tests recorded.

The location of the flue with reference to the setting of the boilers is shown in the accompanying Sketch No. 2, which is a longitudinal section through the boiler with the Hawley furnace, showing the principal features of the entire equipment. Sketch No. 3 shows likewise a longitudinal section through the boiler with the Murphy furnace.

The Murphy furnace and stoker is of the usual pattern built at the present time by the Murphy Iron Works. It has two magazines for the reception of the coal, located in the sidewalks, two inclined grates with ash pocket and clinker bar at the very bottom along the central line, and a double fire-brick arch over the furnace, extending from one end of the grate to the other. The engine by which the mechanism is operated performs three functions. It gives the feed boxes in the sides of the magazines at the top of the grate a lateral motion; it works the lower end of each alternate grate bar, up and down; and it operates a ratchet, through which the clinker bar is rotated. A constant supply of air is furnished to the two sides of the furnace above the fuel, entering through two openings in the front, and first passing through the hollow arch. A further supply can be admitted through regulated openings provided with registers. The coal is furnished to the magazines by hand, being shoveled into the doors in the front and pushed back with a hoe. The mechanism of the furnace can be disconnected so that either the feeding boxes, the grates, or the clinker bar, can be operated by hand. There are two small openings through the front on a line with the surface of each grate, through which a rod can be introduced for the purpose of slicing the grate, or of stirring up the coal, and thus assisting the operation of the stoking apparatus. There is also provided a fire door in the front, through which clinkers can be removed, and through which the fire can be worked by hand, if necessary. The coal is fed to the top of the grates through a long slot, and through this opening the feeding can be assisted by the use of a poker.

The exhaust steam from the stoking engine passes into the interior of the clinker bar, which is hollow, and escapes through openings into the ash pit. In addition to the steam from this source, live steam can be supplied through a ¼-inch valve connected to the exhaust pipe.

The Hawley furnace is constructed after the plan customarily followed at the present time by the Hawley Company. Of the two grates the upper one consists of two 10-inch headers connected by twenty-nine 2-inch extra heavy pipes 5 feet 6 inches long, arranged in two staggered rows. Above the furnace is a "water arch," so-called, consisting of two 8-inch headers connected by twenty 2-inch pipes 3 feet 2 inches long. The lower grate is a cast iron flat grate of ordinary construction. In the setting of this boiler there is no brick arch provided at the rear of the furnace over the combustion chamber, as sometimes arranged with the Hawley designs. The controlling feature of the Hawley furnace consists in the downward draft system, by means of which the products of combustion from the green coal on the main grate are forced to pass through the bed of live coal below and over the incandescent fuel on the grate beneath, before they reach the heating surfaces of the boiler.

The principal dimensions of the boilers are given in the accompanying Table No. 1, and those of the furnaces in Table Nos. 2 and 3.

Table No. 1.

DIMENSIONS OF EACH BOILER.

1	Diameter of each shell	80 in.
2	Length of tubes	18 ft.
3	Number of tubes 4 inches in diameter	57
4	Number of tubes 4½ inches in diameter	51
5	Diameter of drum	54 in.
6	Average length of drum	23 ft. 4 in.
7	Area of water heating surface	2,279 sq. ft.
8	Area of steam heating surface	150 sq. ft.
9	Area for draft between tubes in the upper bank	10.6 sq. ft.
10	Area for draft through middle tiling at rear end	7.4 sq. ft.
11	Diameter of steam pipe	8 in.

Table No. 2.

DIMENSIONS OF HAWLEY FURNACE.

12	Length of tubes in the upper grate	5 ft. 6 in.
13	Number of tubes 2⅜ inches outside diameter, arranged staggered	29
14	Diameter of headers in grate	10 in.
15	Number of tubes 2⅜ inches outside diam. in water arch	20
16	Diameter of headers in water arch	8 in.
17	Area of heating surface exposed by the tubes and headers in the grate	123 sq. ft.
18	Width of upper and lower grate	7 ft.

19	Length of lower grate	6 ft.
20	Width of air spaces in lower grate	½ in.
21	Width of metal bars in lower grate	⅝ in.
22	Total water heating surface in boiler with Hawley furnace, including surface in grate	2,402 sq. ft.
23	Area of upper grate-surface	38.5 sq. ft.
24	Area of lower grate-surface	42 sq. ft.
25	Collective area of both grates	80.5 sq. ft.
26	Ratio of water heating surface to upper grate surface	62.4 to 1
27	Ratio of water heating surface to total grate surface	29.8 to 1
28	Ratio of total grate surface to tube opening	7.6 to 1
29	Ratio of total grate surface to opening through tiling	10.9 to 1

Table No. 3.

DIMENSIONS OF MURPHY FURNACE AND STOKER.

30	Length of grate	6 ft.
31	Width of grate, in horizontal projection	6 ft.
32	Width of grate surface, measured on the incline	7 ft.
33	Width of air spaces in grates	¼ in.
34	Width of metal bars in grates	9/16 in.
35	Collective area of opening in the front for supplying air above fuel	48 sq. in.
36	Collective area of openings through registers supplying air above fuel, when half open	52 sq. in.
37	Area of grate surface	42 sq. ft.
38	Ratio of water heating surface to grate surface	54.3 to 1
39	Ratio of grate surface to draft opening between tubes	4 to 1
40	Ratio of grate surface to opening through tiling	5.6 to 1
41	Diameter of stoker engine	3 in.
42	Stroke of stoker engine	5 in.
43	Revolutions of stoker engine for one double stroke of feed boxes and grate mechanism	1,120
44	Stroke of grates at lower ends	1½ in.

Each of the boilers is fitted with a Hoppes live steam purifier, the dimensions of which over all are: diameter, 40 inches, and length 16 feet 4 inches. Through this apparatus the water is fed on its way to the boiler. The purifier fitted to the Murphy boiler was opened and cleaned prior to the tests of this boiler, and the writer examined its interior. At that time the boiler had run about two weeks (the time covered by the series of tests which were abandoned) since it was previously cleaned. The pans in the interior which serve for the collection of sediment were found to contain a small quantity of thick muddy water, which lay in the bottom. There was no scale either in the inside or on the under surface of the pans.

As a result of the examination of the two boilers which the writer made at the very beginning of his work, it was found that the interior surfaces of the Murphy boiler were practically clean and free from scale. In the Hawley boiler there was a thin deposit of scale in the lower ends of some of the tubes. The quantity, however, was insufficient, in the writer's opinion, to have a material effect in reducing the efficiency of the boiler. The exterior surfaces of the tubes of both boilers were found in practically the same condition, there being a greater or less collection of soot and ashes on portions of the tube surface which are out of reach of the steam jet, but the surfaces were otherwise clean. The brick work and tiling of both boilers were intact, so far as could be determined by inspection.

The boilers are ordinarily supplied with water from the hot wells of the pumping engines by means of the pumps attached to the engines, but for these tests it was supplied by a direct-acting steam pump erected for the occasion.

There are in all at the Water Works twelve boilers. Out of this number four boilers generally suffice to furnish the required amount of steam for the engines. At the time of the tests, three of the boilers in the eastern section of the boiler room were used, together with the one undergoing the test, there being at no time more than two engines in operation at once. The work of the pumping station is continuous night and day, and the force of employes is divided into three watches of eight hours each, with two firemen and one or two coal passers on each watch. On the occasion of these tests, one of the firemen on each watch was detailed to operate the boiler undergoing test, leaving the other three boilers for the other firemen.

Nature of Tests and General Manner of Conducting Them.

The tests were complete evaporative trials, conforming in general to the "standard" method of the American Society of Mechanical Engineers, each test being commenced with a new fire started with wood and the coal being entirely burned out at the close. The tests were nominally of 24 hours' duration, or one complete day's run. During their progress the firing was done by the regular employes of the Works under the supervision of the writer or his assistant. Each test covered the time of three watches, so that the work of firing was divided among three men, and it may be added, that the same three men participated in all the tests.

In order that suitable observations might be made of the character of the smoke issuing from the chimney, without interference from the smoke produced by the other boilers of the station, the boiler undergoing test was connected independently to the west chimney, the remaining boilers in the station which were under steam being connected to the east chimney, as already stated. The dampers of the idle boilers connecting into the west chimney, and all doors in the setting of the same, were carefully closed, to exclude the unnecessary introduction of cold air. Nevertheless, this chimney was undoubtedly cooled to a considerable extent by the air and leakage, and the draft was less than it would have been under other circumstances. It was found that the draft at the base of this chimney was much less than the draft at the base of the east chimney, into which the three boilers of the eastern section were connected. When, however, the boiler under test was connected to the east chimney.

the draft in the main flue was increased to a small extent only.

Besides the observations which were made on the character of the smoke issuing from the chimney, an apparatus was employed for obtaining a continuous record of the smoke, independent of any personal observations. It consisted of a brass plate ⅞ inch wide by 24 inches long suspended in the smoke passage, which served to collect a sample of the soot that passed by it, the plate being removed at regular intervals, and the soot scraped off. From the total quantity collected, the weight and volume of soot deposited per hour were found. The indications thus obtained furnish a reliable means of comparison. In making the smoke observations at the chimney, careful records were obtained for periods of one to three hours during each trial, and during these periods the quantity and character of the smoke as judged by its appearance to the eye, were observed at intervals of one minute. These records are not intended to give an average for the entire test, as the quantity of smoke varied from hour to hour, according to the amount of clinker and general condition of the fire. They serve, however, to indicate the momentary variations in the smoke emitted. Besides the periods of one-minute observations, the record was taken at the regular times of observing the various instruments, excepting in some parts of the night, when, owing to darkness, the top of the chimney was invisible. In determining the question of smoke prevention, no account was taken of the smoke produced during the starting time when the fires were being lighted at the beginning of the test, the records applying simply to the working portion of the trial after the fires had reached their normal condition of service.

In conducting the evaporative tests, the usual half-hourly observations were made of the steam pressure, temperature of the feed water, temperature of the flue gases, force of the draft, calorimeter temperatures, the condition of the fires, etc., in addition to obtaining the weights of coal, water, etc. A sample of the flue gases was taken from time to time and analyzed by the use of the Orsat apparatus. The coal was sampled and dried for 24 hours in a pan placed on the top of the brick work, thus determining its surface moisture, and afterwards tested for heat units in the writer's coal calorimeter.

On the tests of the Murphy furnace a record was kept of the speed of the engine which drives the stoking apparatus, and of the number of times the working of the stoker was assisted by the fireman, either in poking the coal on the grates, working it down from the magazines, or in assisting the clinker bar and removing clinkers.

All the data of the tests, with the exception of the feed water weights, were taken either by the writer, or by his associate, Mr. W. S. Monroe, of Chicago. The writer was on watch, as a rule, from 10 a. m. to 10 p. m., and Mr. Monroe from 10 p. m. to 10 a. m. The water was weighed by two assistants, one of whom was on watch from noon to midnight, and the other from midnight to noon.

The tests of each series were made on consecutive days, the process of closing one trial serving as a preparation for the beginning of the next.

At the beginning of each trial, or at the very close of the preceding trial, the tubes of the boiler were cleaned, using the steam jet blowing apparatus.

The tests were run with as near as possible a constant draft, that is, the damper was set in a fixed position and was only changed when it was found that the rate of evaporation required that the draft be increased or diminished.

At the conclusion of the main tests, the quantity of steam consumed by the stoker engine and the live steam jet of the Murphy furnace was determined by condensing it for a suitable period in a tub of water, weighing the tub before and after.

Tt the conclusion of the main tests, the quantity of tests should be 200 H. P. It will be seen from the records that the actual figures were slightly different in every case. It is well nigh impossible to adjust the condition of fire and draft and other controlling circumstances so as to obtain exactly a predetermined rate of capacity. The variations from the desired 200 H. P. are not sufficient, however, to produce any important influence on the character of the results.

Apparatus for the Tests.

Each boiler, while undergoing test, was entirely cut off in respect to its water connections from the rest of the plant, either by breaking the connecting pipes and plugging them, or by the introduction of blank flanges.

The boilers were proved to be tight by observing that there was no fall of water in the gauge glass when under steam with no fire in the furnace. That there was no avenue of escape for the water between the measuring tanks and the boiler was proved by working the feed pump with the stop valves at the purifier closed, and observing that there was no loss of water at the tank.

For *measuring the feed water*, two tanks were erected, one placed on scales above the other, and the lower one serving as a reservoir for supplying the pump before referred to. The upper tank, which had a capacity of about 1,400 pounds of water, was supplied from the regular feed water service of the station, the temperature of which ranged from 110 to 130 degrees.

The *coal* was brought in from the sheds by a small hand car having a maximum capacity of about 2,000 pounds, and was weighed on the platform scales of the station. These scales were verified by the sealer of weights, and by comparison with the water scales.

The *temperature of the feed water* was taken by a thermometer immersed in a well placed in the feed pipe close to the pump.

The *steam pressure* was observed from the steam guage attached to the boiler, corrected for slight errors.

The *temperature of the flue gases* was obtained from a pot of oil containing a thermometer, which was suspended in the flue passage on the side of the drum, just in front of the point where the gas comes up from beneath. Its location is shown in the Sketches Nos. 2 and 3. When the thermometer was read the oil pot was temporarily withdrawn from the flues.

The *force of the draft* was found by the use of the writer's differential draft gauge, which multiplies the ordinary indication expressed in the height of a water column 8.3 times. This was connected to the smoke passage at the side of the drum.

The *smoke meter* was located at a point four inches to the rear of the thermometer pot and a little to one side.

The *gas samples* were taken from a ¼-inch pipe, open at the end, which extended into the smoke passage at a point about two inches from the smoke meter, where it was believed that a fair sample of the gas would be secured. A small lead pipe conducted the gas from this point to the floor of the boiler room, where the sampling bottles and Orsat apparatus were manipulated.

The steam calorimeter, which was one of the writer's instruments, 1895 pattern, was attached to a sampling pipe, which was inserted in the main steam pipe at a distance of about six feet from the steam drum, at the point where the pipe curves and changes its direction from vertical to horizontal. The sampling pipe, which was of the ½-inch size, contained forty-eight ½-inch holes, and extended across the full diameter of the 8-inch main. The location of the calorimeter is shown on the sketches. In determining the moisture from the data, reference is made the heat balance table. The inherent moisture in the various coals, the surface moisture having been removed, was found by laboratory tests (one hour heating at 212°) to be as follows:

	Hawley Test.
Pocahontas	.85%
Hocking	3.51%
Jackson	1.1 %
Bellmore	5.3 %

Method of Handling the Furnaces.

In making the tests with the Murphy furnace, it was the intention that the furnace should be operated in a manner conforming to the best working practice. The stoking mechanism is not perfectly automatic, and in order to obtain a perfect condition of feeding, and secure a fire of uniform and proper thickness over the entire grate, it is necessary to assist the mechanism by occasionally poking the coal down from the magazines, slicing the grates, operating the various parts of the mechanism by hand, and sometimes removing clinkers. This is specially true of coals which contain a considerable percentage of ash, or which have a tendency to form an excessive amount of clinker. In operating the mechanism for the purpose of these tests, it was considered that good working practice was not what might be called most perfect operation, such as would be secured by constant attendance of the fireman, and continual assistance of the mechanism whenever it failed in the least particular, but more by that sort of attendance which would be given by a faithful employee who had a number of furnaces of this kind to handle. The stoker for this reason was allowed to perform its work, so far as practicable, in its legitimate manner, but the condition of the fire was frequently examined by the fireman, and, at least every half hour, it was observed by the writer, or by his associate.

It is confidently believed that the operation of the stoker on all these tests was more carefully attended to than it would be under any ordinary practice. The extent of the assistance which was given to the stoker by the fireman will be seen by reference to the following table:

NUMBER OF TIMES MURPHY STOKER WAS ASSISTED BY FIREMAN.

Kind of Coal	Pocahontas.	Hocking.	Jackson.	Bellmore.
Date, June, 1897	27–28	23–24	26–27	24–25
Slicing Clinker Bar	9	48	18	43
Turning " "	7	61	10	58
Poking	22	92	15	57
Total of all operations (except firing)	38	201	43	158
No. times per hour	1.7	9.6	2.	6.9

In the case of the test of the Murphy furnace with Hocking slack, it was necessary to have the damper wide open for the greater part of the time, and the fireman had constantly to assist the mechanism by poking, slicing, or otherwise working the fire by hand, to evaporate the required quantity of water.

The thickness of fire carried on the Murphy grates varied from two to five inches—not taking into account the bare spots which appeared from time to time. With a thinner bed of coal, it was impossible to keep the grates properly covered, without undue assistance of the fireman. On the test of the Pocahontas coal, the registers used for the auxiliary supply of air above the grates were closed. On the remaining tests they were half way open. On all the tests except the one with Jackson coal, the live steam supply to the clinker bar was kept in use. On the test with the Jackson coal, it was shut off and only exhaust steam from the engine entered the ash pit.

The clinker bar was operated by the single cog ratchet on the tests of the Pocahontas and Jackson coal, and with the three cog ratchet on the tests of the Bellmore pea and Hocking slack. The former rotates the clinker bar one tooth at a revolution, while the latter rotates it three teeth.

On the test of the Pocahontas coal, the lumps were broken up previously to shoveling the coal into the magazines, into pieces about the size of a 2-inch cube.

On the test of this furnace with Pocahontas coal, there was a considerable quantity of fine coal which fell through the upper parts of the grates in an unburned condition and collected in a pile on the outer sides of the ash pit. The ashes and clinkers from the coal were deposited in a pile lying in the center. When the ashes and clinkers were removed, they were carefully separated from the coal on the sides, and the coal was weighed separately. It has been the practice at the pumping station to save this coal and fire it back into the magazines. In order that proper data might be secured for the purposes of the test, the practice was not followed on this occasion.

On the tests of the Hawley furnace, the fire on the upper grate was maintained at a thickness of from six to nine inches, according to the class of fuel. That on the lower grate was from two to four inches when Pocahontas coal was used, and generally thicker with the other coals. On all the tests the ash doors of the lower grate were kept, to some extent, open, the amount of coal burned on the lower grate being varied according to the rate of evaporation.

On the tests with all the coals except the Pocahontas, it was necessary to keep the damper wide open and to use the slice bar frequently, and work a comparatively large amount of coal from the upper to the lower grate in order to keep up the power required. Furthermore, unless the lower grate was kept well cleaned, and careful attention was given to keeping a good supply of coal on that grate, it was difficult to secure the desired rate of evaporation, while with the Hocking coal it was found practically impossible to attain 200 H. P.

On all the tests with the Hawley furnace, the coal was wet before it was fired. The quantity of water used was 60 to 80 pounds per ton of coal, which corresponds to from 3 to 4 per cent of moisture.

On account of the difficulty experienced on the test of the Hawley furnace with Hocking slack coal in developing the required power, a supplementary test was made on this furnace with the draft taken from the east chimney, and at the same time the boiler with the Murphy furnace was in operation, connecting to the same chimney. On this test the average draft was increased 17 per cent, but this was not accompanied by any increase of capacity.

Data and Results.

The data and results of the tests are given in the accompanying tables.

Table No. 4, in its several parts, presents the complete records obtained during the period of one-minute observations of the smoke issuing from the chimney. The abbreviations used in this table for the smoke density are as follows: Tr., Trace; V. L., Very Light; L., Light; M., Medium; B., Brown; D. B., Dense Brown; B. B., Black. The various operations of the fireman during these periods are also indicated.

Table No. 5 presents a summary of the smoke records of Table No. 1, and of the half-hourly observations during the trials, giving, in each case, the average percentage of smoke, using an arbitrary basis of calculation. This basis consists in fixing the value of a "trace" at 1 per cent; "very light" smoke at 5 per cent; "light" smoke at 10 per cent; "medium" smoke at 15 per cent; "brown" smoke at 20 per cent; "dense brown" smoke at 25 per cent, and "black" smoke at 50 per cent. The table also gives the records of the smoke meter, showing the average weight of soot deposited per hour on each test, together with its volume.

Table No. 6 gives the principal data and results of the evaporative trials arranged in four parts, one for each fuel. The percentage of efficiencies given in this table are calculated without allowance for the evaporation of the moisture in the coal. The calorimeter determinations were made on samples of the coal from the Hawley tests and the efficiencies of both furnaces are based on these figures.

Table No. 7 presents a summary of the evaporative results obtained on all the tests.

Table No. 8 presents a summary of all the tests, giving the cost of fuel required to evaporate the water necessary to run the station for a year on the basis of the various results, assuming the total quantity to be 125,000,000 pounds of water from and at 212°.

Table No. 9 presents the average results of the gas analyses on the various tests.

Table No. 10 gives a complete "heat balance" for the tests with the Pocahontas and Hocking slack.

Conclusions.

1. SMOKE PREVENTION.

When using Pocahontas coal, the Murphy furnace was practically smokeless. The average half-hourly observations and the one minute observations show an entire absence of smoke, and there was only one occasion when smoke was seen at the chimney. This occurred when the fire was disturbed to an unusual degree. The furnace was not absolutely smokeless, for there was a deposit of 12.1 milligrammes of soot per hour on the smoke meter, With the same coal, the Hawley furnace on the half-hourly observations at the chimney, showed 2.1 per cent of smoke (using the arbitrary basis of measurement determined upon), and on the one-minute observations, numbering in all 180, it showed 1.9 per cent. The quantity of smoke measured by the smoke meter was 48.8 milligrammes per hour.

When using Hocking slack coal, the half-hourly observations at the chimney, on the test of the Murphy furnace, gave 3.3 per cent of smoke, and the one-minute observations, numbering 104, showed 0.9 per cent. The record of the smoke meter was 9.3 milligrammes per hour. With this coal, the Hawley furnace showed 7.2 per cent of smoke on the half-hourly readings, and 5.5 per cent on the one-minute observations, numbering 162. The smoke meter gave 164.2 milligrammes per hour.

The test on the Murphy furnace with Jackson nut and slack coal showed 3.2 per cent of smoke on the half-hourly observations of the chimney, and 1.1 per cent on the one-minute observations, which numbered 91. The smoke meter here gave 151.4 milligrammes of soot per hour. On the Hawley test, the chimney observations gave 8.3 per cent and 4 per cent, respectively; the number of the latter being 232. The smoke meter showed 184.1 milligrammes per hour. There were times when the Murphy stoker produced a greater quantity of smoke with Jackson coal than the Hawley furnace produced on any occasion (see page 125, Table No. 4), but for the whole period of the tests the smoke meter showed that the Hawley furnace made the larger quantity.

When using Bellmore pea coal, the average half-hourly observations on the Murphy furnace showed 1.3 per cent of smoke, and the one-minute observations, numbering in all 152, 0.5 per cent. The record of the smoke meter was 34.3 milligrammes per hour. On the test of the Hawley furnace, the chimney observations gave 9.6 per cent and 6.9 per cent, respectively, the latter covering 169 readings, and the smoke meter showed 97.9 milligrammes of soot per hour.

It will be noticed from the tables that the volume of the soot deposited on the smoke meter shows even a greater difference in favor of the Murphy furnace than that indicated by the weight.

On the whole, it appears that the Murphy furnace operated with decidedly greater efficiency in point of smoke prevention than the Hawley furnace, with all of the four coals used.

2. ECONOMY.

The result of the evaporative test on the Murphy furnace using Pocahontas coal was 10.864 pounds of water from and at 212° evaporated into dry steam per pound of dry coal, and that of the Hawley furnace was 11.53 pounds. Expressed in the cost of coal used for one year's run of the pumping station, assuming that the whole work is done on this basis, and that the total evaporation for the year is 125,000,000 pounds from and at 212°, the cost of coal for the Murphy furnace is $14,775, and for the Hawley furnace $13,925. The difference in these quantities is $850, in favor of the Hawley furnace per year, or 5.8 per cent. If no allowance is made for the coal which fell through the grates of the Murphy furnace the difference in favor of the Hawley furnace is $2,325 for a year, or 14 per cent. On the same basis of cost, it appears, further, that the Hawley furnace gave the best results when using Pocahontas coal of any of the coals tested.

On the tests of the Hocking, Jackson, and Bellmore coals, the Murphy furnace gave a higher evaporative result than the Hawley furnace. The economy shown in favor of the Murphy furnace was 5.6 per cent with Hocking coal, 10.5 per cent with Jackson coal, and 6 per cent with Bellmore coal. These percentages of economy correspond to a yearly saving on the entire fuel consumption as above assumed, amounting to $850, $1,787, and $962 respectively. In point of cost, however, none of these fuels, whether burned in the Murphy furnace or in the Hawley furnace, gave the economy obtained with the Pocahontas coal on the Hawley test.

The summary of costs given in Table No. 8 shows that in the case of the Murphy furnace, the cheapest coal is the Hocking Slack, but this does not take into account the element of labor expended in firing. When the cost of the increased labor and the annoyance which accompanies it are considered, it is evident that the most economical fuel for the pumping station with the prices quoted, is the Pocahontas coal, whichever furnace be used.

It is seen, therefore, that for the purpose of the Water Works, the Hawley furnace gave a higher efficiency in point of economy than the Murphy furnace.

3. CAPACITY.

The instructions given by the Board to the writer were that no comparison of the furnaces should be made on a basis of capacity, but that the tests should all be run with the boilers developing 200 H. P. As the work went forward, certain facts in regard to capacity were brought out which it falls within his duties to report. These facts do not relate to comparative figures between the furnaces, but to another matter entirely.

It is admitted by all parties to these contracts, that the furnaces were to be capable of developing at the least rating 200 H. P., this being the capacity of the boilers according to the builders' guarantee. Now, the tests were to be made with different kinds of coal sold in the market, and it is evident that the furnaces were to be of the capacity stated with all of the coals. The tests with Hocking coal on both furnaces and with Jackson and

Bellmore coal on the Hawley furnace, developed the fact that it was only by the utmost exertion of the firemen, that the desired power was realized, and in the case of the Hawley furnace with Hocking coal even this could not be done. For reasons stated in this report, under head of "Interpretation of Contracts," the furnaces should have a working capacity of at least 200 H. P., and not a capacity of that amount reached only forced conditions. Consequently with at least one of the fuels the intention of the contract failed to be carried out, in the case of either furnace.

4. Attention should be called to the fact that owing to the low draft and the consequent crowding of the fires to secure the desired power, the results of the trials on the Hawley furnace, both as to the prevention of smoke and as to economy when using the low grades of coal (Hocking, Jackson, and Bellmore), are not a criterion of the performance which would result under more favorable conditions. When the Hawley furnace is operated with insufficient draft, as obtained in this case, the main objects to be secured by the Hawley system are largely defeated. It is necessary in such a case to resort to burning a large proportion of the coal on the lower grate, with the result that the furnace then approaches to the conditions of the ordinary system of combustion.

The draft was sufficient for the satisfactory burning of Pocahontas coal in the Hawley furnace, and it was sufficient in the matter of economy, for the requirements of the Murphy furnace, on all four coals.

5. There is no occasion for entering upon a discussion of the tests in their scientific and engineering aspects, although the records are sufficiently complete for any such purpose. It may be noted briefly that a study of the figures of "efficiency" realized, given in Table No. 6, and those of the heat balance in Table No. 10, furnishes a satisfactory verification of the main features of the evaporative results which are at issue.

Addendum.

The writer received a communication from the Hawley Furnace Co., dated June 23, 1897, making certain protests in regard to the tests, and it seems proper to reply to them in this report. The protests were as follows:

> "First—We protest against the burning of refuse coal, that was passed through the grate bars into the ash pit and later removed and put back into the furnace. In making furnace tests, it is supposed a fact that the furnace will properly consume the fuel, without having to take the refuse out of the ashes and put back into the furnace, which requires additional labor and is not done by firemen in actual practice.
>
> Second—Under our contract each of the furnaces were to be in operation six (6) months before tests were made. The Murphy device was rebuilt three different times within six (6) months prior to tests and each time entirely new grate bars were put in place, consequently the Murphy furnace is not longer in existence and could not be tested against the Hawley furnace that has been in use six (6) months, without one cent for repairs or any changes made.
>
> Third—Our contract provides that we furnish the Water Department with 250 H. P. capacity, which is also stipulated in the contract of our opponent, and we request that at least one test be made using Pocahontas coal, at 250 H. P. rating on each furnace."

The first protest applies especially to the test of the Murphy furnace with Pocahontas coal, in which about 10 per cent of the coal which was fired fell through the grates unburned. Loss of coal in this manner is certainly an indication of a defect, and in a comparison between a furnace where this occurs, and the Hawley furnace in which there is no such action, the matter must be regarded as of special importance. The practice at the pumping station has been to remove this waste coal and refire it. It seems proper, therefore, to give credit for it in working out the results of the tests, as otherwise they will not conform with the usage of the station. It should be said that it requires the expenditure of labor to save this loss. Further, in the event of equipping the whole plant with this type of furnace, together with a system of coal-handling and ash-handling machinery which often accompanies automatic stokers, much, if not all, of this coal would be carried away with the ashes and wasted. In recognition of these facts and records showing the relative economy of the two furnaces are reported both ways. Whether the allowance is made for the waste coal or not, the result is the same, that is, the relative economy in either case is favorable to the Hawley furnace.

The second protest has no bearing on the tests so far as the writer is concerned, but it seems fit that he should reply to it so far as to state what changes have been made in the Murphy Stoker since its erection, according to what he believes to be reliable information. The grates in use at the time of the tests, were the fourth set that had been applied, having been renewed at intervals of from one to two months. The writer was shown samples of each set that had been removed. These were somewhat burned on the upper edge but were otherwise in good order. These changes were made with a view to reducing the quantity of unburned coal which dropped through and the last change consisted mainly in cutting down the width of the air spaces. Some time after the introduction of the furnace the clinker bar broke and it was replaced by a new one. After this occurrence, the exhaust steam supply was supplemented by attaching the ¼-inch live steam pipe.

The third protest contains a request which it seemed unnecessary to comply with, especially since it was found impossible to develop 250 H. P. with any coal except the Pocahontas. In view of this fact, there was little reason for making a test at that rate on the one coal mentioned.

Table No. 4.

SMOKE RECORDS. (ONE MINUTE OBSERVATIONS.)

Murphy Furnace. Pocahontas Coal. June 27-28, 1897.

Time.	Smoke.	
8.30 A.M.	0	
8.31 "	0	
8.32 "	0	
8.33 "	0	
8.34 "	0	
8.35 "	0	
8.36 "	0	
8.37 "	0	
8.38 "	0	
8.39 "	0	
8.40 "	0	
8.41 "	0	
8.42 "	0	
8.43 "	0	
8.44 "	0	
8.45 "	0	
8.46 "	0	
8.47 "	0	
8.48 "	0	
8.49 "	0	
8.50 "	0	
8.51 "	0	
8.52 "	0	
8.53 "	0	
8.54 "	0	
8.55 "	0	Slice.
8.56 "	0	
8.57 "	0	
8.58 "	0	
8.59 "	0	
9.00 "	0	
9.01 "	0	Poke.
9 02 "	0	
9.03 "	0	
9.04 "	0	
9.05 "	0	
9.06 "	0	
9.07 "	0	
9.08 "	0	
9 09 "	0	
9.10 "	0	
9.11 "	0	
9.12 "	0	
9.13 "	0	
9.14 "	0	
9.15 "	0	
9.16 A.M.	0	
9.17 "	0	
9.18 "	0	
9.19 "	0	
9.20 "	0	
9 21 "	0	
9.22 "	0	Poke.
9.23 "	0	
9.24 "	0	
9.25 "	0	
9.26 "	0	
9.27 "	0	Slice.
9.28 "	0	
9 29 "	0	
9.30 "	0	
9.31 "	0	
9.32 "	0	
9.33 "	0	
9.34 "	0	
9.35 "	0	
9.36 "	0	
9.37 "	0	
9.38 "	0	
9.39 "	0	
9.40 "	0	Poke.
9.41 "	0	
9.42 "	0	
9.43 "	0	
9.44 "	0	
9.45 "	0	
9.46 "	0	
9.47 "	0	
9.48 "	0	
9.49 "	0	
9.50 "	0	
9.51 "	0	
9.52 "	0	
9.53 "	0	
9.54 "	0	
9.55 "	0	
9.56 "	0	
9.57 "	0	Slice.
9.58 "	0	
9.59 "	0	
10.00 "	0	

During a subsequent period, smoke was observed only once, this occurring after poking and slicing the fire. In this case it was simply a trace.

TABLE NO. 4.—(Continued.)

SMOKE RECORDS. (One Minute Observations.)

Hawley Furnace. Pocahontas Coal. June 15-16, 1897.

Time.	Smoke.	
3.12 P.M.	VL	
3.13 "	Tr	Fire.
3.14 "	Tr	
3.15 "	VL	
3.16 "	Tr	
3.17 "	0	Bar.
3.18 "	0	
3.19 "	Tr	Fire.
3.20 "	VL	
3.21 "	Tr	
3.22 "	0	Fire.
3.23 "	VL	
3.24 "	Tr	
3.25 "	0	
3.26 "	0	
3.27 "	0	
3.28 "	0	
3.29 "	0	
3.30 "	0	
4.45 "	Tr	Fire.
4.46 "	L	
4.47 "	VL	Fire.
4.48 "	L	
4.49 "	VL	
4.50 "	Tr	
4.51 "	Tr	
4.52 "	0	
4.53 "	0	
4.54 "	0	
4.55 "	0	Fire.
4.56 "	Tr	
4.57 "	VL	
4.58 "	L	
4.59 "	Tr	
5.00 "	VL	
5.15 "	0	Bar.
5.16 "	0	
5.17 "	VL	Fire.
5.18 "	0	
5.19 "	VL	Fire.
5.20 "	Tr	
5.21 "	Tr	
5.22 "	Tr	Fire.
5.23 "	Tr	
5.24 "	VL	
5.25 "	Tr	Fire.
5.26 "	L	Fire.
5.27 "	VL	
5.28 "	VL	
5.29 "	Tr	
5.30 "	Tr	
5.49 "	Tr	Fire.
5.50 P.M.	L	
5.51 "	VL	Fire.
5.52 "	L	
5.53 "	VL	Bar.
5.54 "	VL	
5.55 "	Tr	Level.
5.56 "	L	
5.57 "	VL	Fire.
5.58 "	M	Fire.
5.59 "	VL	
6.00 "	L	
7.08 "	0	Fire.
7.09 "	VL	
7.10 "	Tr	
7.11 "	0	Fire.
7.12 "	VL	
7.13 "	VL	
7.14 "	Tr	
7.15 "	0	
7.16 "	0	
7.17 "	0	
7.18 "	0	Fire.
7.19 "	0	
7.20 "	VL	
7.21 "	0	
7.22 "	0	Fire.
7.23 "	VL	
7.24 "	Tr	
7.25 "	0	
7.26 "	0	Fire.
7.27 "	0	
7.28 "	VL	
7.29 "	0	
JUNE 16, A. M.		
6.10 A.M.	0	
6.11 "	0	
6.12 "	0	
6.13 "	0	
6.14 "	0	
6.15 "	0	
6.16 "	0	
6.17 "	0	Fire.
6.18 "	VL	
6.19 "	0	
6.20 "	0	
6.21 "	0	
6.22 "	0	
6.23 "	0	
6.24 "	0	
6.25 "	0	Fire.
6.26 "	VL	

TABLE NO. 4.—(Continued.)

SMOKE RECORDS. (One-Minute Observations.)

Hawley Furnace. Pocahontas Coal. June 15–16, 1897.

Time.	Smoke.		Time.	Smoke.	
6.27 A.M.	0		7.52 A.M.	0	
6.28 "	0		7.53 "	0	
6.29 "	0		7.54 "	0	
6.30 "	0		7.55 "	0	
6.31 "	VL		7.56 "	0	
6.32 "	0		7.57 "	0	
6.33 "	0		7.58 "	0	Fire.
6.34 "	0		7.59 "	VL	
6.35 "	0		10.54 "	Tr	Level.
6.36 "	0		10.55 "	Tr	Fire.
6.37 "	0		10.56 "	VL	
6.38 "	0		10.57 "	VL	
6.39 "	0		10.58 "	VL	
6.40 "	0		10.59 "	Tr	
6.41 "	0	Fire.	11.00 "	Tr	Level.
6.42 "	0		11.01 "	Tr	
6.43 "	Tr		11.02 "	0	
6.44 "	0		11.03 "	VL	
6.45 "	0		11 04 "	VL	
6.46 "	0		11.05 "	Tr	Bar.
7.06 "	0		11.06 "	0	Fire
7.07 "	0		11.07 "	Tr	
7.08 "	0		11.08 "	VL	
7.09 "	0		11.55 "	0	
7.10 "	0		11.56 "	0	
7.11 "	0	Fire.	11.57 "	0	
7.12 "	Tr		11.58 "	0	
7.13 "	Tr		11.59 "	0	
7.14 "	LT		12.00 "	0	
7.41 "	Tr		12.01 P.M.	0	Bar & Level.
7.42 "	Tr		12.02 "	0	
7.43 "	0		12.03 "	0	Fire.
7.44 "	Tr		12.04 "	L	
7.45 "	Tr		12.05 "	VL	
7.46 "	0		12.06 "	VL	Level & Fire.
7.47 "	0		12.07 "	VL	Fire.
7.48 "	0		12.08 "	VL	
7.49 "	0		12.09 "	VL	
7.50 "	0		12.10 "	Tr	
7.51 "	0				

TABLE NO. 4.—(CONTINUED.)

SMOKE RECORDS. (ONE-MINUTE OBSERVATIONS.)

Murphy Furnace. Hocking Slack, June 23-24, 1897.

Time.	Smoke.		Time.	Smoke.	
5.30 P.M.	0		5.36 A.M.	0	Turn CB.
5.31 “	0		5.37 “	Tr	
5.32 “	0		5.38 “	0	
5.33 “	0	Feed.	5.39 “	0	
5.34 “	0	Slice CB.	5.40 “	0	
5.35 “	Tr		5.41 “	0	
5.36 “	0	Poke.	5.42 “	0	
5.37 “	DB		5.43 “	0	
5.38 “	VL		5.44 “	0	
5.39 “	VL		5.45 “	0	
5.40 “	0		5.46 “	0	
5.41 “	0		5.47 “	0	Poke.
5.42 “	0		5.48 “	0	
5.43 “	0		5.49 “	Tr	
5.44 “	0		5.50 “	0	
5.45 “	0	Feed.	5.51 “	0	
5.46 “	0		5.52 “	0	
5.47 “	0		5.53 “	0	
5.48 “	0		5.54 “	0	
5.49 “	0		5.55 “	0	Poke.
5.50 “	0		5.56 “	0	
5.51 “	0		5.57 “	0	Turn CB.
5.52 “	0		5.58 “	0	
5.53 “	0		5.59 “	0	
5.54 “	0		6.00 “	0	
5.55 “	0	Slice CB.	6.01 “	0	
5.56 “	Tr	Feed.	6.02 “	0	
5.57 “	0		6.03 “	0	
5.58 “	L		6.04 “	0	
5.59 “	VL		6.05 “	Tr	Poke.
6.00 “	Tr		6.06 “	0	
6.01 “	0		6.07 “	0	
6.02 “	0		6.08 “	0	
6.03 “	0		6.09 “	0	
6.04 “	0		6.10 “	0	
6.05 “	0		6.11 “	0	
6.06 “	0		6.12 “	0	
6.07 “	0		6.13 “	0	
6.08 “	0		6.14 “	0	
6.09 “	0		6.15 “	Tr	Poke.
6.10 “	0		6.16 “	0	Turn CB.
6.11 “	0		6.17 “	0	
6.12 “	0		6.18 “	0	
6.13 “	0		6.19 “	0	
6.14 “	0	Slice & Fire.	6.20 “	0	
6.15 “	0		6.21 “	0	Poke.
5.30 A.M.	0		6.22 “	Tr	
5.31 “	0		6.23 “	0	
5.32 “	0		6.24 “	0	
5.33 “	0		6.25 “	0	
5.34 “	0		6.26 “	0	
5.35 “	0		6.27 “	0	Poke.

TABLE NO. 4.—(CONTINUED.)

SMOKE RECORDS. (ONE-MINUTE OBSERVATIONS.)

Murphy Furnace. Hocking Slack. June 23–24, 1897.

Time.	Smoke.	
6.28 A.M.	Tr	
6.29 "	VL	
6.30 "	Tr	
6.31 "	Tr	
6.32 "	0	
6.33 "	0	
6.34 "	0	
6.35 A.M.	0	
6.36 "	0	
6.37 "	0	Poke.
6.38 "	Tr	
6.39 "	Tr	
6.40 "	0	

Hawley Furnace. Hocking Slack. June 16–17, 1897.

Time.	Smoke.	
4.05 P.M.	0	Bar.
4.06 "	VL	
4.07 "	M	
4.08 "	M	Fire.
4.09 "	M	
4.10 "	L	
4.11 "	M	
4.12 "	VL	
4.13 "	VL	Fire.
4.14 "	Tr	
4.15 "	Tr	Bar.
4.16 "	VL	Level.
4.17 "	M	
4.18 "	L	
4.19 "	VL	
4.20 "	Tr	
4.21 "	Tr	
4.22 "	0	
4.23 "	0	
4.24 "	0	
4.25 "	0	
4.26 "	0	Bar.
4.27 "	M	
4.28 "	DB	Fire.
4.29 "	DB	
4.30 "	M	
5.54 "	Tr	
5.55 "	Tr	
5.56 "	Tr	Bar.
5.57 "	Tr	
5.58 "	L	Fire.
5.59 "	L	
6.00 "	M	
6.05 "	M	
6.06 "	0	
6.07 "	0	
6.08 "	0	
6.09 "	0	
6.10 "	0	
6.11 P.M.	0	
6.12 "	0	
6.13 "	0	
6.14 "	0	
6.15 "	0	
6.16 "	0	Fire.
6.17 "	0	
6.18 "	Tr	
6.19 "	0	
6.20 "	0	Clean L.
6.21 "	0	
6.45 "	L	Fire.
6.46 "	VL	
6.47 "	VL	
6.48 "	VL	
6.49 "	VL	Bar.
6.50 "	L	
6.51 "	DB	
6.52 "	DB	Fire.
6.53 "	M	Fire.
6.54 "	DB	
6.55 "	M	
6.56 "	M	
6.57 "	M	
6.58 "	L	Fire.
6.59 "	L	
7.00 "	VL	
7.35 A.M.	VL	
7.36 "	Tr	
7.37 "	Tr	
7.38 "	Tr	
7.39 "	0	
7.40 "	0	
7.41 "	Tr	
7.42 "	0	
7.43 "	0	
7.44 "	0	
7.45 "	0	
7.46 "	0	

TABLE NO. 4.—(CONTINUED.)

SMOKE RECORDS. (ONE-MINUTE OBSERVATIONS.)

Hawley Furnace. Hocking Slack. June 16–17, 1897.

Time.	Smoke.	
7.47 A.M.	0	Fire.
7.48 "	VL	
7.49 "	VL	
7.50 "	VL	
7.51 "	Tr	
7 52 "	Tr	
7.53 "	0	
7.54 "	0	Fire.
7.55 "	VL	
7.56 "	VL	
7.57 "	VL	
7.58 "	Tr	
7.59 "	Tr	
8.00 "	0	
8.08 "	VL	Fire.
8 09 "	VL	
8.10 "	VL	
8.11 "	VL	
8.12 "	Tr	
8.13 "	Tr	
8.14 "	Tr	Slice.
8.15 "	0	
8.16 "	0	
8.17 "	0	
8.18 "	0	
8.48 "	0	
8.49 "	0	
8.50 "	0	Slice.
8.51 "	VL	
8.52 "	D	
8.53 "	M	
8.54 "	DB	
8.55 "	L	
8.56 "	VL	Fire.
8.57 "	VL	
8.58 "	L	
8.59 "	VL	
9.00 "	VL	
9.50 "	M	
9.51 "	L	
9.52 "	L	Fire.
9.53 "	VL	
9 54 A.M.	VL	
9.55 "	VL	
9.56 "	L	
9.57 "	L	
9.58 "	L	
9.59 "	VL	
10.00 "	Tr	
11.35 "	L	Level.
11.36 "	L	
11.37 "	L	
11.38 "	L	Bar.
11.39 "	VL	
11.40 "	DB	
11.41 "	DB	
11.42 "	L	
11.43 "	L	Fire.
11.44 "	VL	
11.45 "	VL	
11.46 "	VL	
11.47 "	Tr	
11.48 "	L	
11.49 "	L	
11.50 "	M	
11.51 "	L	
11.52 "	VL	Fire.
11.53 "	VL	
12.36 "	Tr	
12.37 "	Tr	
12.38 "	Tr	
12.39 "	Tr	
12.40 "	0	Fire.
12.41 "	0	Level & C.
12.42 "	0	
12.43 "	Tr	
12.44 "	Tr	
12.45 "	0	
12.46 "	0	Bar.
12.47 "	Tr	Fire.
12.48 "	VL	
12.49 "	Tr	
12.50 "	Tr	
12.51 "	Tr	

TABLE NO. 4.—(Continued.)

SMOKE RECORDS. (One-Minute Observations.)

Murphy Furnace. Jackson Coal. June 26–27, 1897.

Time.	Smoke.	Time.	Smoke.	
6.10 P.M.	VL	6 56 P.M.	0	
6.11 “	VL	6.57 “	VL	
6.12 “	0	6.58 “	Tr	
6.13 “	0	6.59 “	Tr	
6.14 “	Tr	7.00 “	Tr	
6.15 “	Tr	7.01 “	Tr	
6.16 “	Tr	7.02 “	Tr	
6.17 “	Tr	7.03 “	Tr	
6.18 “	0	7.04 “	Tr	
6 19 “	0	7.05 “	Tr	
6.20 “	Tr	7.06 “	Tr	
6.21 “	Tr	7.07 “	Tr	
6.22 “	Tr	7.08 “	Tr	
6.23 “	Tr	7.09 “	Tr	
6.24 “	Tr	7.10 “	Tr	
6.25 “	0	2.15 A.M.	0	
6.26 “	0	2.16 “	0	
6.27 “	0	2.17 “	0	
6.28 “	VL	2.18 “	Tr	
6.29 “	Tr	2.19 “	0	Slice.
6.30 “	Tr	2.20 “	0	
6.31 “	VL	2.21 “	0	
6.32 “	VL	2.23 “	0	
6.33 “	VL	2.23 “	0	
6.34 “	Tr	2.24 “	0	
6.35 “	VL	2.25 “	0	
6.36 “	Tr	2.26 “	0	
6.37 “	0	2.27 “	0	
6.38 “	0	2.28 “	0	
6.39 “	0	2.29 “	0	
6.40 “	Tr	2.30 “	0	
6.41 “	Tr	2.31 “	Tr	
6.42 “	Tr	2.32 “	Tr	
6.43 “	Tr	2.33 “	Tr	
6.44 “	Tr	2.34 “	0	
6.45 “	Tr	2.35 “	0	
6.46 “	Tr	2.36 “	0	
6.47 “	Tr	2.37 “	0	Shake G.
6.48 “	0	2.38 “	0	
6.49 “	0	2.39 “	Tr	
6.50 “	0	2.40 “	L	
6.51 “	0	2.41 “	Tr	
6.52 “	0	2.42 “	0	
6.53 “	0	2.43 “	0	
6.54 “	0	2.44 “	Tr	
6.55 “	Tr			

The above record was taken at a time when the fire was in a very favorable condition, the period of most smoke being at night when it was impossible to take one-minute observations. A period of one hour taken on a preliminary test when the chimney was showing the most smoke gave an average of 10.1% on the arbitrary basis assumed.

TABLE NO. 4 —(CONTINUED.)

SMOKE RECORDS. (ONE-MINUTE OBSERVATIONS)

Hawley Furnace. Jackson Coal. June 17–18, 1897.

Time.	Smoke.	
7.20 P.M.	0	Fire.
7.23 “	0	
7.24 “	0	Fire.
7.25 “	0	
7.26 “	0	Bar.
7.27 “	0	Level L.
7.28 “	M	Fire.
7.29 “	M	
7.30 “	L	
7.31 “	L	Fire.
7.32 “	L	
7.33 “	L	Fire.
7.34 “	VL	
7.35 “	VL	
7.36 “	VL	
7.37 “	VL	Fire.
7.38 “	Tr	
7.39 “	Tr	
7.40 “	Tr	Fire.
7.41 “	Tr	
7.42 “	0	
7.43 “	0	
7.44 “	0	
JUNE 18.		
5.56 A.M.	L	
5.57 “	VL	
5.58 “	VL	
5.59 “	VL	
6.00 “	VL	
6.01 “	VL	
6.02 “	Tr	
6.03 “	Tr	
6.04 “	Tr	
6.05 “	Tr	
6 06 “	0	
6.07 “	0	Fire.
6.08 “	VL	
6.09 “	VL	
6.10 “	VL	
6.11 “	Tr	
6.12 “	0	
6.13 “	0	
6.14 “	0	
6.15 “	0	
6.16 “	0	
6.17 “	0	
6.18 “	0	
6.19 “	0	
6.20 “	0	
6.21 “	0	
6.22 “	0	
6.23 A.M.	0	
6.24 “	L	
6.25 “	M	
6.26 “	DB	Fire.
6.27 “	DB	
6.28 “	MB	
6 29 “	MB	
6.30 “	L	
6.31 “	VL	Fire.
6.32 “	L	
6.33 “	M	
6.34 “	M	
6.35 “	L	
6.36 “	L	
6.37 “	L	
6.38 “	VL	
6.39 “	VL	
6.40 “	VL	Fire.
6.41 “	L	
6.42 “	VL	
6.43 “	VL	
6.44 “	Tr	
6.45 “	0	
6.46 “	0	
6.47 “	0	
6.48 “	0	
6.49 “	0	
6.50 “	0	Fire.
6 51 “	0	Bar.
6.52 “	L	
6.53 “	M	Fire.
6.54 “	DB	
6.55 “	DB	
6.56 “	VL	
8.01 “	0	
8.02 “	0	
8.03 “	Tr	
8.04 “	Tr	
8.05 “	0	
8.06 “	0	Slice L.
8.07 “	Tr	
8.08 “	Tr	Fire little.
8.09 “	0	
8.10 “	Tr	Slice L.
8.11 “	0	
8.12 “	0	
8.13 “	0	Slice U.
8.14 “	0	Fire.
8.15 “	M	
8.16 “	M	
8.17 “	L	
8.18 “	L	

TABLE NO. 4.—(CONTINUED.)

SMOKE RECORDS. (ONE-MINUTE OBSERVATIONS.)

Hawley Furnace. Jackson Coal. June 17-18, 1897.

Time.	Smoke.		Time.	Smoke.	
8.19 A.M.	Tr		10.31 A.M.	Tr	
8.20 “	L	Fire.	10.32 “	Tr	
8.21 “	Tr		10.33 “	Tr	
8.22 “	Tr		10.34 “	0	
8.23 “	0		10.35 “	0	Slice U.
8.24 “	0		10.36 “	L	Fire.
8.25 “	0	Fire.	10.37 “	M	
8.26 “	0		10.38 “	L	
8.27 “	0		10.39 “	L	
8.28 “	0		10.40 “	VL	Fire.
8.29 “	0	Fire.	10.41 “	VL	
8.30 “	0		10.42 “	Tr	
8.31 “	0	Slice L.	10.43 “	Tr	
8.32 “	0	Slice U.	10.44 “	0	
8.33 “	L	Fire.	10.45 “	0	
8.34 “	L		10.46 “	0	
8.35 “	M		10.47 “	Tr	Fire.
8.36 “	L		10.48 “	0	
8.37 “	VL		10.49 “	0	
8.38 “	VL		10.50 “	0	Slice L.
8.39 “	Tr		10.51 “	0	Fire.
8.40 “	0	Fire.	10.52 “	0	
8.41 “	0		10.53 “	0	
8.42 “	0		10.54 “	0	
8.43 “	0		10.55 “	0	
8.44 “	0		10.56 “	0	
8.45 “	0	Fire.	10.57 “	0	Bar.
8.46 “	0		10.58 “	L	
8.47 “	0		10.59 “	L	
8.48 “	0		11.00 “	L	
8.49 “	0		11.01 “	VL	Fire.
8.50 “	0		11.02 “	0	Fire.
8.51 “	0	Fire.	11.03 “	0	
8.52 “	0	Slice U.	11.04 “	0	Fire.
8.53 “	Tr	Fire.	11.05 “	0	Fire.
8.54 “	0		11.06 “	0	
8.55 “	ML		11.07 “	Tr	
8.56 “	Tr		11.08 “	Tr	Level.
8.57 “	Tr		11 09 “	Tr	
8.58 “	0		11.10 “	Tr	Fire.
8.59 “	0		11.11 “	Tr	
9.00 “	0		11.12 “	Tr	
10.21 “	VL		11.13 “	0	
10.22 “	VL		11.14 “	0	
10.23 “	L		11.15 “	0	Slice L.
10.24 “	L		11.16 “	0.	Bar.
10.25 “	L		11.17 “	VL	Fire.
10.26 “	VL		11.18 “	L	Fire.
10.27 “	VL		11.19 “	L	
10.28 “	VL		11.20 “	VL	
10.29 “	Tr		3.08 P.M.	0	Fire.
10.30 “	Tr		3.09 “	0	Fire.

TABLE NO. 4.—(CONTINUED.)

SMOKE RECORDS. (ONE-MINUTE OBSERVATIONS.)

Hawley Furnace. Jackson Coal. June 17-18, 1897.

Time.	Smoke.	
3.10 “	0	
3.11 “	0	Fire.
3.12 “	Tr	
3.13 “	Tr	
3.14 “	Tr	
3.15 “	Tr	
3.16 “	Tr	
3.17 “	Tr	
3.18 “	0	
3.19 “	0	
3.20 “	0	Bar.
3.21 “	M	Slice L.
3.22 “	L	Fire.
3.23 “	L	
3.24 “	M	
3.25 “	L	
3.26 “	VL	Fire.
3.27 “	VL	Fire.
3.28 “	Tr	
3.29 “	Tr	
3.30 “	Tr	
3.31 “	0	Fire.
3.32 “	0	
3.33 “	0	
3.34 “	0	Bar.
3.35 “	Tr	Fire.
3.36 “	M	
3.37 “	L	

Table No. 1.—(Continued.)

SMOKE RECORDS. (ONE-MINUTE OBSERVATIONS.)

Murphy Furnace. Bellmore Coal. June 24-25, 1897.

Time.	Smoke.	
5.37 P.M.	0	
5.38 “	0	
5.39 “	Tr	Turn C.
5.40 “	Tr	
5.41 “	0	Slice C.
5.42 “	Tr	Poke.
5.43 “	VL	
5.44 “	L	
5.45 “	Tr	
5.46 “	0	
5.47 “	0	
5.48 “	0	
5.49 “	0	
5.50 “	0	
5.51 “	0	
5.52 “	Tr	
5.53 “	0	
5.54 “	Tr	
5.55 “	0	
5.56 “	0	Turn C.
5.57 “	0	
5.58 “	0	
5.59 “	Tr	
6.00 “	Tr	
6.01 “	0	Slice C.
6.02 “	VL	
6.03 “	VL	
6.04 “	VL	
6.05 “	VL	
6.06 P.M.	Tr	
6.07 “	Tr	
6.08 “	VL	Poke.
6.09 “	Tr	
6.10 “	L	
6.11 “	0	
6.12 “	0	
6.13 “	0	Poke.
6.14 “	VL	
6.15 “	0	
6.16 “	0	
6.17 “	0	
6.18 “	0	
6.19 “	0	
6.20 “	0	
6.21 “	0	
6.22 “	0	
6.23 “	0	
6.24 “	0	
6.25 “	0	
6.26 “	0	Turn C poke.
6.27 “	0	
6.28 “	Tr	
6.29 “	Tr	
6.30 “	0	
6.38 “	0	
7.53 “	0	
7.54 “	0	Slice C.
7.55 “	Tr	

TABLE NO. 1.—(Continued.)

SMOKE RECORDS—(One-Minute Observations.)

Hawley Furnace. Bellmore Coal. June 24-25, 1897.

Time.	Smoke.		Time.	Smoke.	
7.56 P.M.	0		6.07 A.M.	0	
7.57 "	0		6.08 "	Tr	
7.58 "	0		6.09 "	0	
7.59 "	0		6.10 "	0	
8.00 "	0	Turn C.	6.11 "	0	
8.01 "	0		6.12 "	0	
8 02 "	0	Poke.	6.13 "	0	
8.03 "	0		6 14 "	0	
8.04 "	0		6.15 "	0	
8.05 "	0		6.16 "	0	
8.06 "	0		6.17 "	0	
8.07 "	0		6.18 "	0	
8.08 "	0		6.19 "	0	
8.09 "	0		6.20 "	0	
8.10 "	0		6.21 "	0	
8.11 "	0		6.22 "	0	
8.12 "	0	Turn C.	6.23 "	0	
8.13 "	0		6.24 "	0	
8.14 "	0		6.25 "	0	
8.15 "	0		6.26 "	0	
8.16 "	0		6.27 "	0	
8.17 "	0		6.28 "	0	
8.18 "	0		6.29 "	0	
8.19 "	0		6.30 "	0	
8.20 "	0		6.31 "	0	
8.21 "	0		6 32 "	0	Poke.
8.22 "	0		6.33 "	0	
5.50 A.M.	0		6.34 "	0	
5.51 "	0		6.35 "	0	
5.52 "	0		6.36 "	0	Poke.
5.53 "	0		6.37 "	0	
5.54 "	0		6.38 "	0	
5.55 "	0	Turn C.	6 39 "	0	
5.56 "	0		6.40 "	0	
5.57 "	0		6.41 "	0	
5.58 "	0		6.42 "	0	
5.59 "	0		6.43 "	0	
6.00 "	0	Turn C.	6.44 "	0	
6.01 "	0	Slice.	6.45 "	0	Turn C.
6.02 "	Tr		6.46 "	0	
6.03 "	Tr		6.47 "	0	
6.04 "	0		6.48 "	0	
6.05 "	0		6.49 "	0	
6.06 "	0	Poke.	6.50 "	0	

TABLE NO. 1.—(CONTINUED.)

SMOKE RECORDS. (ONE-MINUTE OBSERVATIONS)

Hawley Furnace. Bellmore Coal. June 18-19, 1897.

Time.	Smoke.	
5.40 P.M.	0	
5.41 “	0	
5.42 “	0	
5.43 “	0	
5.44 “	0	
5.45 “	0	
5.46 “	Tr	Clean.
5.47 “	Tr	Lower.
5.48 “	Tr	Bar.
5.49 “	M	
5.50 “	VL	
5.51 “	M	
5.52 “	L	
5.53 “	L	
5.54 “	VL	
5.55 “	VL	
5.56 “	L	
5.57 “	L	Clean L.
5.58 “	VL	
5.59 “	VL	
6.00 “	VL	
6.01 “	VL	Fire.
6.02 “	M	
6.03 “	M	Bar.
6.04 “	DB	
6.05 “	DB	
6.06 “	DB	
6.07 “	M	
6.08 “	M	
6.09 “	M	
6.10 “	DB	
6.11 “	M	
6.12 “	L	
6.13 “	L	
6.14 “	L	
6.15 “	L	
6.16 “	L	
6.17 “	VL	
6.18 “	VL	
6.19 “	VL	
6.20 “	VL	
6.21 “	VL	
6.22 “	Tr	
6.23 “	Tr	
6.24 “	Tr	
6.25 “	0	
6.26 “	0	Bar.
6.27 “	0	
6.28 “	0	Level.
6.29 “	0	Fire
6.30 “	L	
6.31 “	M	
6.32 P.M.	DB	
6.33 “	DB	Fire.
6.34 “	B	
6.35 “	DB	
6.36 “	M	
6.37 “	M	
6.38 “	L	
6.39 “	L	
6.40 “	0	
7.01 A.M.	L	
7.02 “	L	
7.03 “	L	Bar.
7.04 “	VL	
7.05 “	MB	Fire.
7.06 “	MB	
7.07 “	L	
7.08 “	L	
7.09 “	L	
8.00 “	VL	
8.01 “	VL	
8.02 “	VL	
8.03 “	Tr	
8.04 “	Tr	
8.05 “	0	
8.06 “	0	
8.07 “	0	
8.08 “	0	
8.09 “	0	
8.10 “	0	
8.11 “	0	
8.12 “	0	
8.13 “	0	
8.14 “	0	
8.15 “	0	
8.16 “	0	Slice L.
8.17 “	0	
8.18 “	0	
8.19 “	0	
8.20 “	0	
8.21 “	0	Clean L.
8.22 “	Tr	
8.23 “	Tr	Bar U.
8.24 “	VL	Fire.
8.25 “	Tr	
8.26 “	M	
8.27 “	L	
8.28 “	VL	Fire.
8.29 “	Tr	
8.30 “	Tr	
8.31 “	Tr	
8.32 “	Tr	
8.33 “	Tr	

TABLE NO. 1.—(CONTINUED.)

SMOKE RECORDS. (ONE-MINUTE OBSERVATIONS)

Murphy Furnace. Bellmore Coal. June 24–25, 1896.

Time.	Smoke.	
8.34 A.M.	Tr	
8.35 “	Tr	
8.36 “	0	
8.37 “	0	
8.38 ‘	0	Clean 2.
8.39 “	0	Half of.
8.40 “	0	Lower
8.41 “	0	
8.42 “	0	Bar U.
8.43 “	VL	Fire.
8.44 “	M	
8.45 “	M	
8.46 “	M	Fire.
8.47 “	M	
8.48 “	L	
8.49 “	L	
8.50 “	L	
2.05 P.M.	0	Clean L.
2.06 “	VL	
2.07 “	VL	
2.08 “	Tr	
2.09 “	Tr	
2.10 “	Tr	Bar.
2.11 “	L	
2.12 “	M	
2.13 “	VL	Fire.
2.14 “	M	
2.15 “	M	
2.16 “	M	
2.17 “	L	
2.18 “	VL	
2.19 “	0	
2.20 “	0	
2.21 “	Tr	Bar.
2.22 P.M	Tr	Fire.
2.23 “	M	Fire.
2.24 “	M	
2.25 “	L	
2.26 “	VL	Fire.
2.27 “	M	
2.28 “	VL	
2.29 “	Tr.	Fire.
4.06 “	VL	Bar.
4.07 “	VL	Level L.
4.08 “	VL	
4.09 “	VL	Fire,
4.10 “	VL	Fire.
4.11 “	DB	
4.12 “	M	
4.13 “	M	Fire.
4.14 “	M	Fire.
4.15 “	M	
4.16 “	M	
4.17 “	L	Fire.
4.18 “	VL	
4.19 “	VL	
4.20 “	VL	
4 21 “	Tr	
4.22 “	Tr	
4.23 “	0	
4.24 “	0	Bar.
4.25 “	0	Fire.
4.26 “	0	
4.27 “	L	
4.28 “	VL	Bar.
4 29 “	VL	Fire.
4.30 “	0	

Table No. 5.

AVERAGES OF SMOKE RECORDS.

COAL.	FURNACE.	Date June, 1897.	Half-hourly observations for whole test.	One-minute observations for certain periods.	Soot deposit on smoke meter.	Volume of soot deposit on smoke meter.
			Per cent.	Per cent.	Milligrammes per hour.	Cubic minimum per hour.
1. Pocahontas	Murphy	27–28	0.	0.	12.1	34.
2. Pocahontas	Hawley	15–16	2.1	1 9	48.8	192.
3. Hocking	Murphy	23–24	3.3	0.9	9.3	33.
4. Hocking	Hawley	16–17	7.2	5.5	164.2	938.
5. Jackson	Murphy	26–27	*3.2	*1.1	151.4	409.
6. Jackson	Hawley	17–18	8.3	4.0	184.1	871.
7. Bellmore	Murphy	24–25	1.3	0.5	34.3	92.
8. Bellmore	Hawley	18–19	9.6	6.9	97.9	624.

* See Table 4, page 131.

Table No. 6.

DATA AND RESULTS OF EVAPORATIVE TESTS AT DETROIT WATER WORKS.

Kind of coal	Pocahontas. (Run of Mine)	
Furnace	Murphy.	Hawley.
Date 1897.	June 27-28.	June 15-16.
Duration (total water fed ÷ hourly rate while fires were in normal condition) hrs.	24.9	23.9
OBSERVATIONS (AVERAGES.)		
1. Average steam pressure (gauge reading corrected) lbs.	64.4	64.4
2. Force of draft between damper and boiler in.	0.2	0.16
3. Temperature of feed water deg.	119.3	124.7
4. Temperature of escaping gases deg.	509.	462.
5. Temperature of external air (signal service 8 A. M.) deg.	63.	73.
6. Moisture in steam per cent.	0.3	0.56
7. Revolutions of Stoker shaft per hour (Murphy)	11.8	......
TOTAL FUEL.		
8. Wood used in lighting fire lbs.	50.	200.
9. Coal as fired lbs.	*15,536	14,264
10. Moisture in coal (surface moisture) per cent.	1.32	1.97
11. Total dry coal consumed (including wood equivalent) lbs.	15,354	14,063
12. Total ash and refuse lbs.	1,071	1,099
13. Percentage of ash and refuse in dry coal per cent.	7.0	7.8
14. Calorific value, by oxygen calorimeter per lb., dry coal B. T. U.	......	14,289
15. Calorific value, by oxygen calorimeter per lb., combustible B. T. U.	......	15,172
FUEL PER HOUR.		
16. Dry coal consumed per hour lbs.	616.6	588.4
17. Dry coal per sq. ft. of grate per hour:		
(Upper Hawley) lbs.	15.28	
(Both Hawley) lbs.	14.68	7.31
TOTAL WATER.		
18. Total water fed to boiler lbs.	150,469	145,384
19. Deduction for Stoker engine and jet (Murphy) lbs.	2,080	......

*After deducting 1471 lbs. which fell through grates.

TABLE NO. 6.—(CONTINUED.)

Kind of coal	Pocahontas. (Run of Mine)	
Furnace	Murphy.	Hawley.
20. Net water fed to boiler...lbs.	148,389	145,384
21. Net water evaporated, corrected for quality of steam...lbs.	147,944	144,540
22. Equivalent water evaporated into dry steam from and at 212 degrees...lbs.	166,792	162,160
WATER PER HOUR AND HORSE POWER.		
23. Net water evaporated per hour into dry steam...lbs.	5,957.9	6,069.4
24. Equivalent evaporation per hour from and at 212 degrees...lbs.	6,714.5	6,784.9
25. Equivalent evaporation per hour per sq. ft. of water heating surface...lbs.	2.9	2.8
26. Horse power on basis of 34½ lbs. per hour and at 212 degrees...H. P.	194.6	196.8
ECONOMIC RESULTS.		
27. Water evaporated into dry steam per lb. of dry coal...lbs.	9.636	10.278
28. Equivalent evaporation from and at 212 degrees per pound of dry coal...lbs.	10.864	11.530
29. Equivalent evaporation from and at 212 degrees per pound of combustible...lbs.	11.681	12.505
30. Efficiency based on combustible (or efficiency of boiler)...per cent.	74.3	79.6
31. Efficiency based on coal (or efficiency of boiler and furnace)...per cent.	73.4	77.9
32. Cost of fuel used in evaporating 1000 lbs. of water from and at 212 degrees...cents	11.82	11.14
33. Cost of fuel used for one year's run of pumping station...dollars (125,000,000 lbs. from and at 212 degrees)	14,775 ** 16,250	13,925
SMOKE RECORD.		
34. Average percentage of smoke from half hourly observations of chimney...per cent.	0.	2.1
35. Weight of soot shown by smoke meter per hour...mgs.	12.1	48.8

**Including that of coal lost through grates.

TABLE NO. 6.—(Continued.)

Kind of coal	Hocking.	Slack.
Furnace	Murphy.	Hawley.
Date 1897.	June 23-24.	June 16-17.
Duration (total water fed ÷ hourly rate while fires were in normal condition) hrs.	22.2	24.4
OBSERVATIONS (AVERAGES.)		
1. Average steam pressure (gauge reading corrected) lbs.	63.9	64.
2. Force of draft between damper and boiler in.	0.26	0.28
3. Temperature of feed water deg.	123.7	124.9
4. Temperature of escaping gases deg.	495.	468.
5. Temperature of external air (signal service 8 A. M.) deg.	68.	66.
6. Moisture in steam per cent.	0.41	0.6
7. Revolutions of Stoker shaft per hour (Murphy)	14.2	......
TOTAL FUEL.		
8. Wood used in lighting fire lbs.	93.	300.
9. Coal as fired lbs.	19,428	21,873
10. Moisture in coal (surface moisture) per cent.	5.2	5.2
11. Total dry coal consumed (including wood equivalent) lbs.	18,455	20,856
12. Total ash and refuse lbs.	3,004	3,325
13. Percentage of ash and refuse in dry coal per cent.	16.3	15.9
14. Calorific value, by oxygen calorimeter per lb., dry coal B. T. U.	......	11,083
15. Calorific value, by oxygen calorimeter per lb., combustible B. T. U.	......	12,814
FUEL PER HOUR.		
16. Dry coal consumed per hour lbs.	831.3	854.8
17. Dry coal per sq. ft. of grate per hour:		
(Upper Hawley) lbs.	19.79	22.20
(Both Hawley) lbs.	......	10.62
TOTAL WATER.		
18. Total water fed to boiler lbs.	138,321	145,621
19. Deduction for Stoker engine and jet (Murphy) lbs.	2,237	
20. Net water fed to boiler lbs.	136,084	145,621
21. Net water evaporated, corrected for quality of steam lbs.	135,524	144,751
22. Equivalent water evaporated into dry steam from and at 212 degrees lbs.	152,150	162,350

TABLE NO. 6.—(CONTINUED.)

Kind of coal..................................	Hocking.	Slack.
Furnace....................................	Murphy.	Hawley.
WATER PER HOUR AND HORSE POWER.		
23. Net water evaporated per hour into dry steam..................................lbs.	6,104.7	5,939.1
24. Equivalent evaporation per hour from and at 212 degrees...........................lbs.	6,853.6	6,660.1
25. Equivalent evaporation per hour per sq. ft. of water heating surface..............lbs.	3.0	2.8
26. Horse power on basis of 34½ lbs. per hour from and at 212 degrees..............H. P.	198.6	193.0
ECONOMIC RESULTS.		
27. Water evaporated into dry steam per lb. of dry coal..............................lbs.	7,343	6,941
28. Equivalent evaporation from and at 212 degrees per pound of dry coal..........lbs.	8,243	7,783
29. Equivalent evaporation from and at 212 degrees per pound of combustible......lbs.	9,848	9,255
30. Efficiency based on combustible (or efficiency of boiler)..................per cent.	74.2	69.8
31. Efficiency based on coal (or efficiency of boiler and furnace)...............per cent.	71.8	67.8
32. Cost of fuel used in evaporating 1000 lbs. of water from and at 212 degrees......cents	11.52	12.20
33. Cost of fuel used for one year's run of pumping station...................dollars	14,400	15,250
SMOKE RECORD.		
34. Average percentage of smoke from half-hourly observations of chimney....per cent.	3.3	7.2
35. Weight of soot shown by smoke meter per hour...............................mgs.	9.3	164.2

TABLE NO. 6.—(CONTINUED.)

Kind of coal	Jackson Nut and Slack.	
Furnace	Murphy.	Hawley.
Date, 1897.	June 26-27.	June 17-18.
Duration (total water fed ÷ hourly rate while fires were in normal condition), hrs.	23.0	24.9
OBSERVATIONS (AVERAGES.)		
1. Average steam pressure (gauge reading corrected), lbs.	64.	64.3
2. Force of draft between damper and boiler, in.	0.19	0.27
3. Temperature of feed water, deg.	120.1	123.8
4. Temperature of escaping gases, deg.	484.	499.
5. Temperature of external air (signal service 8 A. M.), deg.	59.	66.
6. Moisture in steam, per cent.	0.52	0.45
7. Revolutions of Stoker shaft per hour (Murphy)	14.6	......
TOTAL FUEL.		
8. Wood used in lighting fire, lbs.	90.	300.
9. Coal as fired, lbs.	17,495	21,804
10. Moisture in coal (surface moisture) per cent.	3.6	5.7
11. Total dry coal consumed (including wood equivalent), lbs.	16,901	20,688
12. Total ash and refuse, lbs.	1,134	1,556
13. Percentage of ash and refuse in dry coal, per cent.	6.7	7.5
14. Calorific value, by oxygen calorimeter per lb., dry coal, B. T. U.	......	12,139
15. Calorific value, by oxygen calorimeter per lb., combustible, B. T. U.	......	12,832
FUEL PER HOUR.		
16. Dry coal consumed per hour, lbs.	734.8	830.8
17. Dry coal per sq. ft. of grate per hour:		
(Upper Hawley), lbs.	......	21.58
(Both Hawley), lbs.	17.49	10.32
TOTAL WATER.		
18. Total water fed to boiler, lbs.	140,137	152,810
19. Deduction for Stoker engine and jet (Murphy), lbs.	1,036	......
20. Net water fed to boiler, lbs.	139,101	152,810
21. Net water evaporated, corrected for quality of steam, lbs.	138,375	152,125
22. Equivalent water evaporated into dry steam from and at 212 degrees, lbs.	155,860	170,790

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FORTY-FIFTH
ANNUAL REPORT
OF THE
BOARD OF WATER COMMISSIONERS

WATER WORKS.

TO THE
COMMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR
1896.

Calvert Lith.Co.Detroit

FORTY-FIFTH ANNUAL REPORT

OF THE

Board of Water Commissioners

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1896.

DETROIT:
JOHN F. EBY & COMPANY.
1897.

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BOARD OF WATER COMMISSIONERS.

DETROIT, 1896-97.

MEMBERS:

ALBERT L. STEPHENS, 1897. JOHN P. HUCKESTEIN, 1898.
EDWARD W. PENDLETON, 1899. DARIUS D. THORP, 1900.
JOHN W. McGRATH, 1901.

COMMITTEES:

WAYS AND MEANS	Commissioners PENDLETON, HUCKESTEIN
EXTENSION AND CONSTRUCTION	Commissioners THORP, McGRATH.
PUMPING WORKS	Commissioners McGRATH, PENDLETON.
SUPPLIES	Commissioners HUCKESTEIN, THORP.

OFFICERS:

PRESIDENT	ALBERT L. STEPHENS.
VICE-PRESIDENT	JOHN P. HUCKESTEIN.
GENERAL SUPERINTENDENT SECRETARY	L. N. CASE.
CIVIL ENGINEER	G. S. WILLIAMS.
SUPT. OF EXTENSION	HENRY BRIDGE.
SUPT. OF METERS AND INSPECTION	THOMAS R. PUTNAM.
SUPT. OF GROUNDS	E. A. SCRIBNER.
CHIEF ENGINEER AT PUMPING WORKS	URIAH GOULD.
METER CLERK	HARRY S. STARKEY.
ASSESSORS AND COLLECTORS	FRED. H. HUTAFF. W. W. WILCOX. JOHN J. ROBINSON. PETER J. BECKER. THOS. W. GOODALE. ANTHONY VOGEL. CHARLES J. PATERSON. GEORGE A. WINSLOW.
RECEIVING CLERK	GEORGE E. KUNZE.
PERMIT CLERK	JOHN E. LONG.
PURCHASING AGENT	THOMAS E. LYNCH.
AUDITOR	J. A. M. MORETON.

BOARD OF WATER COMMISSIONERS

OF THE CITY OF DETROIT.

METER RATES:

First 3,000 cubic feet each month, each 1,000 gals.	6¾ cts
All over, each 1,000 gals.	2¾ "
Monthly minimum rate	50 "

ASSESSMENT RATES

FROM APRIL 1st, 1896:

		PER ANNUM.
For Family, household purposes		$4 00
Additional Families to first, in same house supplied with one faucet, each		2 00
Green Houses—Special rates.		
Private Stable, for each horse		2 00
Livery Stables, " "		2 00
Dray and Team Horses, each		1 00
Cows, each		1 00
Stores and Offices, from	$2 00 to	20 00
Bakeries, average daily use for each bbl. of flour		3 50
Saloons, Groceries and Provision Stores, from	$8 00 to	100 0
Bar, with faucet, from	$8 00 to	50 00
Fish Houses	$10 00 to	100 00
Slaughter Houses—Special rates.		
Hotels and Taverns, in addition to family rate, each room		1 00
Boarding Schools, from	$5 00 to	50 00
Building Purposes, each 1 M brick		02
" " " 100 yards plastering		05
" " " perch stone		0¼
" " " minimum		50 cts.
Printing Offices—Special rates.		
Butcher Stalls, each not less than		3 00
Work Shops, for 10 persons or under		3 00
" " for each additional 10 persons		1 00
Estimated quantities of water each 100 gallons		00
Boarding Houses, in addition to family rate, each boarder		1 00

FIXTURES:

Bath Tubs, for families, first tub		$2 00
" each additional tub		1 00
" public, each tub		5 00
Water Closets, for a family, first closet		3 00
" " each additional		1 00
" " for hotels, stores, factories, etc., for 10 persons		5 00
" " each additional person		25
Rod Water Closets, not less than		6 00
Urinals, not less than		2 00
Wash-Hand Basin for family	$1 00 to	3 00
" " " other purposes, each person		25
Permanent Wash-Tubs		00
Hose	$3 00 to	30 00
" for lawn or street sprinkling—unmetered premises		00
Fountains	$5 00 to	20 00
Street Sprinklers, each wagon		100 00

Where there is a waste of water, a proper increase of rates will be made.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

Water Commissioners' Office,
Detroit, January 20, 1897.

To the Common Council of the City of Detroit:

Gentlemen—The Board of Water Commissioners of the City of Detroit herewith respectfully submit its annual report for the year ending December 31st, 1896.

Accompanying this report are those to the Board of the General Superintendent and the several heads of departments, to which you are respectfully referred for the operations of the Board in detail.

In general, the construction of the past year has been to perfect the system, to equalize the pressure throughout the city, and furnish water at a higher head and in greater volume, so that all the wants of the city may be fully satisfied.

At the Pumping Works, the installation of four new boilers of greater efficiency than those already in use has been successfully completed.

A coal-unloading and carrying apparatus has also been built, which became necessary, as the Board have been forced to abandon the use of crude oil for coal on account of the greatly increased price of the former.

An electric light plant for lighting the grounds has also been completed, under the supervision of the City Electrician, the plant consisting simply of lamps and the necessary wiring, as the Public Lighting Commission furnishes the current therefor.

To the iron pipe system much attention has been given, and, as but little of ordinary distributing pipes have been called for, the Board took the opportunity of laying large mains in certain portions of the city in order to reinforce the system and to reduce the frictional loss to a minimum. One of the incentives to this action of the Board was the great lack of work throughout the city and the urgent demand there was for it, and on account of which the Board decided to anticipate improvements that might have been postponed a year or two.

The extension of water pipe into Highland Park Village, at the expense to the village of a little over $20,000, is an important one and one of considerable benefit to the city as well as to the village. Water will be supplied the village by the Board through a meter at the city limits, until further action, at the rate of 3 cents per each 1,000 gallons.

During the last summer it was determined by the Board to furnish the street car companies water for road sprinkling purposes, without charge, provided that the space so sprinkled should extend six feet outside of the tracks. This was done in the interest of residents along the lines, who suffered considerably from the dust caused by the cars.

The Board, after careful consideration, determined upon another reduction of the rates, and so arranged its schedule, both of metered and assessed rates, as to cause a reduction of the receipts from this source of over $70,000 annually.

The laying of the new 42-inch force main from the Pumping Station, the third of its kind, was completed the past year, and with better results than were anticipated. The same head is now maintained throughout the city, with a reduction in the head at the Pumping Works of eight feet; which means that the lifting to a height of eight feet of all the water pumped into the city is done without any expense in pumping.

To assist in the preservation of pavements, and to prevent the necessity of cutting into them for the laying of service extensions from time to time as the erection of new buildings would necessitate, the Board resolved to make such extensions in streets about to be paved and charge the expense to the lots. Thirteen streets have been so treated with success, economically and otherwise, and the Board are satisfied that its action in this respect was a wise one.

The improvement in the system and the service, and the great reduction in the payments demanded from the people, establishes the motive of your Commissioners, which is, to give to our fellow-citizens the best service possible for the least amount of money.

All of which is respectfully submitted.

ALBERT L. STEPHENS,
JOHN P. HUCKESTEIN,
EDW'D W. PENDLETON,
DARIUS D. THORP,
JOHN W. McGRATH.

REPORT

OF THE

GENERAL SUPERINTENDENT.

January 2d, 1897.

To the Board of Water Commissioners:

Gentlemen—In accordance with the regulations of your honorable body, I submit the following report of the general construction and operation of the works for the year 1896.

The total receipts from all sources were $537,786.11.

The total expenditures were $545,147.10, including the redemption of $50,000 of bonds.

The expenditures for construction, less the receipts therefor, amount to $262,010.73, of which fully $125,000 thereof was for extraordinary construction, practically for the enlargement of the works, such as the completion of the new 42-inch force main, the building of four new boilers, etc., etc.

Pumping Works.

In January it was determined to replace the four marine boilers in the middle room with new ones, and to that end certain requirements were adopted by the Board, and makers of specially constructed boilers were invited to present their several designs and the cost of their installations for the consideration of the Board.

Nine designs of different makes of boilers were presented by representatives of the several companies, with their guarantees of efficiency, and were carefully considered; and the Wood boiler, manufactured by Wickes Bros. of Saginaw, being preferred, a contract was entered into with that firm for their construction and erection, equipped with Hoppes' purifiers, in the sum of $14,682.

These were completed and subjected to a test on November 3d, in which they exceeded their guarantees in every particular, its guarantee of efficiency in economy being 71 per cent and the test showing from 73 to 78 per cent.

Different designs of furnaces for the prevention of smoke were examined, and it was finally determined to equip one of the boilers with the Murphy stoker, one with the Roney stoker and one with the Hawley down-draft furnace, with the agreement that whichever should show, first, the greatest prevention of smoke, and second, the largest percentage of economy, should have the contract of equipping the four boilers.

The Roney Stoker Co. subsequently withdrew from the competition, and two of the boilers have been equipped with the grates of the boiler manufacturers.

Up to the present time, although both of these furnaces have been operated, and satisfactorily, neither has been tested upon the two points of efficiency required.

A contract was entered into with the Russel Wheel & Foundry Co. for the construction of a coal-hoisting and carrying apparatus, which was completed and used in the unloading of 5,000 tons of coal purchased by the Board in July. The cost of the said apparatus was $10,700.

Additions and changes to boiler houses and coal sheds were also planned, and contract therefor entered into with the Russel Wheel & Foundry Co. in the sum of $6,987.

The installation of an electric light plant, particularly for lighting the grounds, was determined upon, and conference had with the Public Lighting Commission, who agreed to furnish the necessary current, the Water Commission to furnish all labor and material for the said plant. This was completed and the grounds lighted for the first time the 14th of December.

The extraordinary expenditures at the Pumping Works during the year were:

Boilers	$ 18,642.00
Labor, digging trenches, etc	2,530.42
Changes and additions coal and boiler houses	7,032.02
Hoisting and carrying apparatus	10,290.00
Staying up canal bank and dredging	1,700.00
Tower toilet room	1,153.44
Painting, glazing, etc	605.64
Paving	3,331.44
Miscellaneous improvements	3,441.69
Aggregating	$48,726.65

Fuel.

Crude oil, under the contract of the previous year, was continued in use until the latter part of April, when the use of hard coal, which the Board had on hand, was commenced and continued until Oct. 1st, from which time "Pocahontas" coal has been used, to the great satisfaction of the Board. The following table, showing the consumption and cost by months of the several fuels, will explain itself:

FUEL AT PUMPING WORKS, 1896.

MONTH.	Gallons of Water Pumped.	OIL CONSUMED.		COAL CONSUMED.		Cost per Million Gals.	Head Pumped Against lbs.	Per Cent of Water by No. 4	REMARKS.
		Gallons.	Cost.	Pounds.	Cost.				
January	1,174,812,489	154,680	$3,372 02	....	$	$2 90	48.57	28.5	Fuel Oil at $2.18 per hundred gallons.
February	1,118,504,155	143,126	3,120 15	....	....	2 79	48.58	35.2	
March	1,167,794,344	151,959	3,312 71	....	....	2 83	46.17	13.4	
April	1,024,538,924	120,879	2,635 16	....	....	2 56	45.79	47.8	
May	1,150,267,608	34,299	747 72	1,053,027	2,300 86	2 65	48.60	35.4	Hard Coal at $4.37 per ton
June	1,097,212,019	....	....	1,223,862	2,595 97	2 36	46.10	30.8	
July	1,175,026,966	....	....	1,274,920	2,669 96	2 27	46.38	44.3	
August	1,164,425,068	....	....	1,348,023	2,904 38	2 49	46.76	18.5	
September	1,094,574,582	....	....	1,408,988	3,072 41	2 80	47.20	......	
October	1,049,752,986	....	....	1,191,632	1,549 12	1 47	46.04	....	Commenced burning "Pocahontas" Coal, cost $2.60 per ton.
November	1,018,579,350	....	....	1,123,869	1,461 02	1 43	45.57	....	
December	1,018,880,880	....	....	1,111,307	1,444 69	1 41	45.22	....	
Totals	13,254,369,371	....	$13,187 76	....	$17,998 41	......	Average 46.75	......	

Particular attention is called to the column headed "Cost per million gallons." In October, November and December the cost is about one-half of that previously.

The considerable differences in the rates of this column are fully explained in the two subsequent columns, the "Head pumped against" and "Percentage of water pumped by No. 4." This engine is the triple expansion built by the Allis Company of Milwaukee, and is in the neighborhood of 20 per cent more economical in operation than either of the other three.

I desire also to call attention to the column marked "Head pumped against." Consulting the report for 1895, I find this "head" averaged 50.65 lbs. and that of the year 1896 was 46.79 lbs., or a decrease of about 4 lbs., notwithstanding the fact that the pressures have been maintained throughout the city and gradually improved, as the report of the Civil Engineer demonstrates. This is entirely due to the new force main and the decrease in resistance caused thereby.

Amount Expended on Pumping Works Grounds.

ITEMS.	Previously Expended.	1896.	Totals.
Land	$35,000 00	$3,331 44	$38,331 44
Force Mains	624,008 53	49 50	624,058 03
Inlet Pipes	90,811 84		90,811 84
Dock, basin and Canal	146,443 60	1,848 00	148,291 60
Conduits and Wells	81,461 70		81,461 70
Engine, Boiler and Coal Houses	197,196 96	17,927 66	215,124 62
Stand Pipe and Tower	30,420 72	1,153 44	31,574 16
Pump Wells	54,221 56		54,221 56
Engines	349,523 37	1,337 25	350,860 62
Boilers	54,711 01	19,338 75	74,049 76
Engineer's House	8,139 75		8,139 75
Sewer	3,666 25		3,666 25
Grounds, Fences and Gateway	116,350 95	13,087 49	129,438 44
Inspection	2,977 86		2,977 86
Miscellaneous	14,212 37	83 30	14,295 67
Totals	$1,809,146 47	$58,156 83	$1,867,303 30

Water.

Dr. W. I. Tibbals, of the Health Department, made an analysis of the water supply last April, and reported it to be in good condition so far as freedom from sewerage and other dangerous contamination is concerned. He says that fine sand and dirt causes the turbid condition of the water which is frequently observed.

The report in detail is as follows (parts per million): Total solids, 124.40; volatile and organic matter, 42; mineral matter, 82.40; free ammonia, .066; albuminoid ammonia, .078; chlorine, 2.55; oxygen absorbed in fifteen minutes, .32; oxygen absorbed in four hours, .64; total suspended matter, 11.10; inorganic suspended matter, 10.37; volatile and organic suspended matter, .73. Bacteriological examination—Bacteria per cubic centimeter, 140; bacillus typhi abdominalis (typhoid fever bacillus), absent; bacillus coli communis, absent.

In conclusion, under this head, I desire particularly to commend to your honorable body Chief Engineer Gould, not because of his faithfulness, as that is what he is paid for, but because of his ingenious and untiring efforts to obtain the greatest results from the least amount of money possible. A considerable saving at the Pumping Station is due to his careful and intelligent management.

Distributing System.

The extensions of distributing mains were considerably less than was estimated at the beginning of the year. This, and the fact that there was much distress in the city because of the lack of work in all its public departments, and in all branches of business and trade, influenced the President to recommend the laying of 13,200 feet of different size mains, varying from 6 inches in diameter to 16 inches, in various parts of the city, for the purpose of reinforcing the system, and which cost about $22,000.

Soon after this was completed, he again recommended, and for the same reasons, the laying of a 30-inch main running diagonally from the 30-inch corner Orleans and Scott to the 42-inch on Canfield, corner St. Antoine. This extension, now nearing completion, was estimated to cost about $28,000, making in all a total of $50,000.

The extension in Highland Park village, costing about $20,000, aggregated a total length of 26,445 feet, and consists of various sizes, from 6-inch to 16-inch.

The expenditure of this money, aggregating about $70,000, was confined almost entirely to the city, as the pipe was made at the Michigan-Peninsular Car Works.

The pipe system is now about as near perfection as it can be made, as pressures are being maintained equably throughout the city, and with a minimum frictional loss. Where formerly complaints of short supplies were of daily occurrence, there has been but one the past year, and this was owing to a local circumstance and immediately remedied.

Under the direction of the Civil Engineer, G. S. Williams, the pipe system is now thoroughly rearranged and upon a proper basis; the elevations of different localities, which has resulted in a uniformity of pressure throughout the entire city, where once they were three and four times as much in some localities as in others.

This rearrangement of the system, together with the beneficial effect of the new force main, has made an increase in the average pressure of 6.7 lbs., with but 1.5 lbs. increased head at the Works. This means that the water is elevated an average of 15½ feet higher than previously, with the engines pumping against an increased elevation of only 3½ feet, a clear gain of 12 feet. In other words, 13,000,000,000 gallons of water have been raised 12 feet without expense as compared to the cost and conditions of former years.

A detailed description of the changes made in the system since 1893 will be found in the Civil Engineer's report, which is interesting to every citizen of Detroit.

Service Extensions.

In July of last year I was instructed by the Board to make service extensions from pipe in street to inside of curb to all lots not already supplied, in streets about to be paved. The expenses of such extensions I was instructed to assess against the lots and to send bills of such expense to the owners or agents of the said lots.

I was also instructed to charge interest on the several amounts at the rate of 6 per cent per annum from Oct. 1, 1896, upon all bills not paid before Jan. 1, 1897. If said bills were not paid previously to the lot being supplied with water, the payment of the same to be demanded and required before doing so.

In compliance with these instructions, extensions were made in thirteen different streets, the total number of lots so connected being 460, and the expense, exclusive of superintendency, hauling and clerical services, amounting to $5,203.72. These extensions averaged 16½ feet each, and with the 10 per cent added for hauling, etc., cost an average price of $12.28 for each extension.

All of the extensions were made of one-inch, "strong" lead pipe, and each supplied with a shut-off cock and iron box inside of the curb.

The following is the balance sheet of this account:

		Dr.	Cr.
Labor and materials		$5,203.72	
Labor—Pay rolls in excess of charges.			$ 5.49
Payments received, including Jan'y 1st			3,934.86
Charged against lots and due			1,645.91
Charges cancelled			68.95
Labor on Ferry ave., work abandoned.			15.41
Labor and material on hand			83.48
Charges of 10% amounted to		515.37	
Charged for inspection	$108.76		
Paid Bd. of P. W.	73.75		
		35.01	
		$5,754.10	$5,754.10

Water Rates.

If there is no change in the schedule of rates, notwithstanding the fact that the total receipts are for the consumption of water by families and by all the business and manufacturing interests in the city as well, the division of total receipts by total families will give each year about the same quotient.

The following table shows that during the ten years previous to 1886 this quotient, or average per family, was practically the same. In 1886 the charges for household purposes were reduced from $5, $6, $7, etc., according to the number in the family, to a flat rate of $5.

Sept. 1, 1890, meter rates were reduced to 3 1/3 cents per 1,000 gallons for quantity exceeding 3,000 cubic feet per month; and under, 6 2/3 cents per 1,000 gallons.

From July 1, 1891, the charge for the use of hose for lawn and street sprinkling was abated on unmetered premises.

From July 1, 1894, the rates for fixtures were largely reduced.

From April 1, 1896, meter rates were reduced to 2 2/9 cents per 1,000 gallons, for all over 3,000 cubit feet monthly consumption.

From July 1, 1896, the rate of $5 upon families for household purposes was reduced to $4.

The effect of the reduction of the meter rate was estimated to make a reduction in the annual income of the Board of $20,000.

The effect of the reduction in the family rate was estimated to reduce the income of the Board about $50,000. The receipts during the last year received three-fourths of the effect of the reduced meter rate and one-half that of the reduced family rate. To estimate properly, then, the aggregate effect of the various reductions, say from 1888, the number of families supplied in 1896 should be multiplied by the rate $9.36, and from the total subtract the actual receipts of 1896, and to the difference add $30,000:

YEARS.	No. of Families Suppli'd	Rates Received for all Purposes.	Average per Family.	REMARKS.
1876.....	20,102	$205,624 74	$10 23	
1877.....	20,345	210,288 12	10 33	
1878.....	20,603	208,193 95	10 10	
1879.....	21,341	218,110 13	10 22	
1880.....	22,465	227,452 73	10 12	$10.21
1881.....	23,749	241,884 32	10 18	General Average.
1882.....	25,442	261,725 79	10 28	
1883.....	27,415	280,049 06	10 21	
1884.....	29,424	300,467 24	10 21	
1885.....	30,533	313,205 10	10 25	
1886.....	31,946	314,952 31	9 86	
1887.....	34,486	322,834 59	9 36	
1888.....	36,863	344,315 26	9 34	$9.36
1889.....	39,158	367,925 27	9 39	General Average.
1890.....	41,467	387,877 73	9 35	
1891.....	43,933	389,079 97	8 85	
1892.....	46,400	402,534 98	8 67	
1893.....	49,817	420,490 83	8 44	
1894.....	49,912	418,728 76	8 39	
1895.....	51,426	428,772 41	8 34	
1896.....	53,941	406,147 82	7.52	

Multiplying 53,941, the number of families supplied the past year, by $9.36, the average rate when meters were first generally introduced, gives the sum of $504,887, which would have been the water rates received had there been no reduction in the rates. Subtracting from this sum the actual receipts, $406,147.82, and adding the $30,000 spoken of above, gives an annual reduction of $128,740 in the total water rates.

At the request of Commissioner Thorp, I have written to all the large cities in the United States for their schedule of water rates, and it being next to impossible to publish the same, I have taken certain consumers in Detroit who ranged from the smallest to the largest in point of consumption, who are metered, and herewith submit the same, showing what they paid in Detroit and what they would have paid in the other cities:

DETROIT.			AMOUNTS WHICH THE SAME CONSUMPTION WOULD REQUIRE TO BE PAID IN THE FOLLOWING CITIES:											
Consumers.	Gallons consumed in one month.	Paid for same.	Cleveland.	Cincinnati.	Milwaukee.	Alleghany.	Boston.	Chicago.	St. Paul	Providence.	Kansas City.	New Orl-a's	Philadelphia.	Washington.
Stroh Brewing Co.........	8,037,000	$179 60	$268 64	$696 54	$462 56	$803 70	$1,279 28	$646 26	$654 26	$1,212 50	$744 93	$653 90	$321 48	$241 11
Mich. Pen. Car Co.........	4,774,500	107 10	255 64	413 78	320 31	477 45	769 92	377 26	391 36	728 67	455 30	410 92	190 98	143 23
Detroit Copper and Brass Rolling Mills	1,967,300	44 72	104 92	170 61	167 42	196 73	345 36	160 68	164 43	307 59	198 65	208 13	78 69	49 01
Detroit Steel and Spring Works...................	989,500	22 97	52 77	85 08	114 86	98 95	235 08	82 46	87 94	160 92	110 68	94 70	39 27	29 68
Murphy, Wasey & Co.....	487,500	11 83	26 06	44 24	77 50	48 75	72 00	42 36	45 80	85 62	65 35	66 75	19 50	14 62
Edson, Moore & Co	177,000	4 93	9 34	17 11	35 40	17 70	31 90	17 46	19 16	35 40	30 61	28 76	7 08	5 31
F. J. Schwankovsky......	36,700	1 82	1 95	4 32	7 20	3 67	6 72	3 67	5 44	7 34	9 90	7 95	1 44	1 10
Jas. Nall & Co.......	22,500	1 50	1 20	3 37	4 50	2 25	5 20	2 25	6 15	4 50	6 70	4 25	90	67
T. H. Eaton & Co...... ...	7,500	50	40	1 50	1 50	75	1 40	75	1 35	1 50	2 70	1 87	30	22

In those cities where the small consumption is less than in Detroit, there is no minimum rate.

DETROIT.			AMOUNTS WHICH THE SAME CONSUMPTION WOULD REQUIRE TO BE PAID IN THE FOLLOWING CITIES:											
CONSUMERS.	Gallons consumed in one month.	Paid for same.	Buffalo	Baltimore.	Rochester.	Jersey City.	Toronto.	Toledo.	Scranton.	Grand Rapids	Los Angeles.	Camden.	Erie.	Lowell.
Stroh Brewing Co.	8,037,000	$179 60	$200 92	$482 22	$964 44	$1,071 60	$1,213 05	$281 29	$642 96	$375 06	$1,929 68	$482 22	$482 22	$1,115 60
Mich. Pen. Car Co	4,774,500	107 10	119 36	286 47	572 94	668 43	602 39	190 98	381 96	222 81	1.146 48	286 47	286 47	619 60
Detroit Copper and Brass Rolling Mills....	1,967,300	44 72	49 18	118 63	236 07	288 53	248 82	108 21	157 38	91 80	472 94	118 03	118 03	306 30
Detroit Steel and Spring Works..................	989,500	22 97	24 73	58 90	118 74	143 90	129 34	64 31	79 16	58 90	236 42	59 37	59 37	164 28
Murphy, Wasey & Co....	487,500	11 83	12 18	29 25	58 50	74 75	63 43	34 12	73 12	35 75	117 80	29 25	29 25	84 00
Edson, Moore & Co........	177,000	4 93	7 08	10 62	21 24	27 14	27 21	14 16	35 40	16 52	43 28	10 62	10 62	32 68
F. J. Schwankovsky	36,700	1 82	*	2 16	4 40	5 52	6 08	3 67	7 34	5 76	9 48	5 50	2 20	6 72
Jas. Nall & Co.	22,500	1 50	*	1 35	2 70	3 45	6 20	2 25	4 55	3 60	6 20	3 82	*	4 20
T. H. Eaton & Co	7,500	50	*	45	90	1 15	1 41	75	1 55	1 50	2 20	1 35	*	1 40

*Minimum rate $50 per annum

*Minimum rate based on size of meter.

DETROIT.			AMOUNTS WHICH THE SAME CONSUMPTION WOULD REQUIRE TO BE PAID IN THE FOLLOWING CITIES:											
CONSUMERS.	Gallons consumed in one month.	Paid for same.	Des Moines.	Cambridge.	Indianapolis.	St. Louis.	Richmond.	San Francisco.	Syracuse.	Newark.	Memphis.	Denver.	Omaha	Louisville.
Stroh Brewing Co.........	8,037,000	$179 60	$803 70	$1,205 55	$442 03	$803 70	$562 59	$1,428 28	$472 22	$723 33	$695 71	$803 70	$803 70	$549 60
Mich. Pen. Car Co.........	4,774,500	107 10	477 45	716 17	262 59	477 45	334 21	862 78	286 47	429 71	534 71	477 45	477 45	353 70
Detroit Copper and Brass Rolling Mills	1,967,300	44 72	196 73	295 69	118 38	245 90	137 71	376 19	118 03	177 05	210 18	196 73	196 73	185 40
Detroit Steel and Spring Works................	989,500	22 97	98 95	148 42	59 37	123 60	69 26	205 37	59 90	97 20	131 91	98 95	98 95	120 30
Murphy, Wasey & Co.....	487,500	11 83	48 75	73 12	34 12	60 93	34 12	119 20	29 25	61 53	87 87	53 62	48 75	66 90
Edson, Moore & Co........	177,000	4 93	17 70	26 55	15 93	30 97	12 39	52 54	16 80	24 95	42 11	21 24	26 55	26 10
F. J. Schwankovsky	36,700	1 82	7 34	5 50	6 60	9 17	2 59	13 20	6 24	5 40	14 26	5 87	9 17	5 50
Jas. Nall & Co.	22,500	1 50	6 75	4 12	4 50	6 75	1 57	8 50	3 90	3 37	9 75	4 05	6 75	2 87
T. H. Eaton & Co........	7,500	50	2 25	1 12	1 75	2 25	52	2 90	1 70	1 12	3 62	1 50	2 62	1 02

As an example of "the sliding scale" adopted in most cities, an aristocracy of prices for which there is no good reason, and which is so arranged that some consumers are supplied with water cheaper than others, I submit the following schedule from Louisville:

First	5,000 gall. daily, at	15c. per 1,000 gall.,	75c. per day
Second	5,000 gall. daily, at	14c. per 1,000 gall.,	70c. per day
Third	5,000 gall. daily, at	13c. per 1,000 gall.,	65c. per day
Fourth	5,000 gall. daily, at	12c. per 1,000 gall.,	60c per day
Fifth	5,000 gall. daily, at	11c. per 1,000 gall.,	55c. per day
Sixth	5,000 gall. daily, at	10c. per 1,000 gall.,	50c. per day
Seventh	5,000 gall. daily, at	9c. per 1,000 gall.,	45c. per day
Eighth	5,000 gall. daily, at	8c. per 1,000 gall.,	40c. per day
Ninth	5,000 gall. daily, at	7c. per 1,000 gall.,	35c. per day
Tenth	5,000 gall. daily, at	6c. per 1,000 gall.,	30c. per day

For additional gallons, 6c. per 1,000 gallons.

In making a comparative table of charges, made under the different schedules of "assessed" rates throughout the United States, much greater difficulty is met with, as the several rates are often upon so entirely a different basis. The only way to make a fair comparison is to take properties of different valuations of certain lineal foot front, of a certain number of rooms and number of stories, and with certain fixtures, and show what the charges would be in the different cities.

The following table is prepared in this manner:

CITIES.	4-Room Cottage, 20 to 25 feet front; value $1 500 and less. 1 family. 1 faucet.	2-Story House, 8 Rooms, 50 feet front; value $1.500 to $3,000. 1 family. 1 faucet.	2-Story House, 8 Rooms, 50 feet front; value $5 000 to $7,000. Bath, Closet, Basin, Hose.	REMARKS.
Detroit	$4 00	$4 00	$10 00	
Cincinnati	4 50	6 50	14 10	Hose figured at $3.00.
Syracuse	5 00	5 00	20 00	
Rochester	4 00	5 00	14 00	
Milwaukee	5 00	8 00	17 50	Hose $4.50.
Albany	7 50	12 00	18 50	
Boston	5 00	7 00	20 00	Val. $500, rate $5 a year.
Chicago	7 00	16 50	26 50	Val. $1,000, rate $6 a year.
Providence	6 00	6 00	23 00	Val. $1,500, rate $7 a year.
Philadelphia	5 00	5 00	13 00	Hose $3.
Cleveland	3 50	5 50	9 50	
St. Paul	3 00	4 90	12 90	Hose $4.
Washington	4 50	12 00	17 00	Hose $5.
Allegheny	7 25	13 25	19 75	Hose $3.
Richmond	5 00	5 00	21 10	Hose $8.
Kansas City	5 50	8 00	26 50	
Lowell	6 00	6 00	16 00	
Cambridge	4 00	4 00	13 00	No hose.
Des Moines	4 00	5 50	19 00	
Jersey City	7 15	19 95	27 95	
Buffalo	3 40	9 30	18 50	Hose $5.
Toledo	5 00	5 00	13 00	Hose $2.
Toronto	4 50	6 50	15 00	Family averages five persons.
Erie	5 00	5 00	15 00	
Grand Rapids	4 00	4 00	12 00	
Scranton	6 00	6 00	18 00	
Los Angeles	7 80	15 00	25 80	

Economy of Waste.

HISTORICAL.

YEARS.	Families Supplied.	WATER PUMPED.		REMARKS.
		Total Quantity.	Per Family.	
1852........	.....	235,840,275	......	
1853........	4,283	303,531,743	70,868	
1854........	4,619	376,265,126	81,460	
1855........	5,282	542,807,364	102,765	
1856........	5,706	692,124,305	121,297	
1857.......	6,189	697,190,523	112,650	
1858.......	6,474	718,091,207	110,919	
1859.......	6,794	782,112,587	115,118	
1860........	6,750	870,036,451	125,185	
1861........	7,128	895,129,423	125,579	
1862........	7,275	994,945,329	136,762	
1863........	7,699	1,035,798,043	134,534	
1864........	7,993	1,019,390,256	127,410	
1865........	8,351	1,040,514,887	125,675	
1866.......	9,089	1,196,317,922	131,622	
1867........	10,242	1,425,535,230	139,186	
1868........	11,544	1,666,545,125	144,364	
1869........	12,774	1,946,810,325	152,400	
1870........	13,722	1,866,060,068	136,000	
1871........	14,896	2,300,150,605	154,414	
1872........	16,035	2,782,292,578	173,513	
1873........	17,019	3,198,393,948	187,930	
1874........	18,853	3,289,872,635	174,511	
1875........	19,606	4,207,454,260	214,600	
1876........	20,102	4,065,134,470	200,225	
1877........	20,345	4,213,239,790	207,090	
1878........	20,603	4,345,743,330	210,927	
1879........	21,341	5,129,599,110	240,348	
1880........	22,465	5,552,965,310	247,183	
1881........	23,749	6,543,127,968	279,722	
1882........	25,442	6,284,000,742	243,062	
1883........	27,415	7,379,327,788	269,170	
1884........	29,424	8,510,614,140	289,260	
1885........	30,533	9,970,829,580	326,886	
1886........	31,946	10,576,571,254	331,070	
1887........	34,486	13,168,859,808	381,860	
1888........	36,863	14.380. 66 670	390.098	
1889........	39,158	12,875,334,453	328,880	Commenced Metering.
1890........	41,467	12,120,944,532	292,300	
1891........	43,933	12,057,261,236	274,470	
1892........	46,400	12,276,612,482	264,582	
1893........	49,817	13,877,977,208	278,579	
1894........	49,912	13,649,779,605	273,476	
1895........	51,426	14,698,451,954	285,818	
1896........	53,941	13,254,369,371	245,719	

For the last eight years there has been an unanimity of sentiment among the different members of the Board upon the subject of the "economy of waste," and to that end it has devoted to the purchase, placing and care of meters a sum averaging each year about $20,000.

The total amount expended during the eight years is $151,834.33. Deducting a fair estimate of the present value of the meters, which is $100,555.04, we have as actually expended $51,279.29 for the eight years, or an average of $6,409.91 annually.

During these years the income of the Board has not been increased by an advance of the rates or in any other way to meet this expenditure, or for any other purpose. On the contrary, the rates have been from time to time reduced until the receipts for water as regulated by the present rates aggregates an annual reduction of $128,740.

A glance at the foregoing table shows that the quantity pumped last year is practically the same as that of 1887.

The supplied population of 1887 was 177,258.

The supplied population of 1896 was 277,256.

This means that 100,000 people, with all the increase in the manufacturing and business interests during the last eight years, were supplied without expense, as far as the cost of pumping water is concerned and the cost for the construction of pumping machinery and pipes necessary to the supply of the large quantity which would have been demanded had no restrictive measures been adopted. Upon the same ratio as that of 1888, although the pumpage would have been much greater, as the foregoing table proves, the quantity of water pumped would have been 21,042 million gallons instead of 13,254 millions.

The following table is of interest:

YEARS.	Supplied Population.	Gallons Pumped.	Cost of Pumping.	**Cost per Person.**
1887............	177,258	13,168,859,808	$57,352 00	**32 1-3 cts**
1888............	189,475	14,380,166,670	60,284 11	**31 4-5 cts**
1889............	201,272	12,875,334,453	61,560 48	**30 1-2 cts**
1890............	213,140	12,120,944,532	54,433 49	**25 1-2 cts**
1891............	225,815	12,057,261,236	53,012 77	**23 4-9 cts**
1892............	238,496	12,276,612,482	53,287 39	**22 1-3 cts**
1893............	256,059	13,877,977,208	46,546 01	**18 1-7 cts**
1894............	256,547	13,649,779,605	48,146 11	**18 3-4 cts**
1895............	264,329	14,698,451,954	51,772 07	**19 3-5 cts**
1896............	277,256	13,254,369,371	53,234 42	**19 1-5 cts**

In the above table, there appears a discrepancy in the cost of pumping in different years that is not explained by the quantity pumped. That of '89 is $1,300 more than that of '88, and the quantity pumped is about 1,500 million gallons less. These unusual discrepancies are accountable for largely by the amounts paid out for "repairs," those of 1888 being $1,700 and those of 1889 over $6,000, the expense for 1888 being a fair average.

At the rate per person of 1888, the cost of pumping for 1896 would have been $88,167, or $34,933 more than the real cost.

In this connection, in considering the saving effected, it should be understood that every additional 24,000,000 gallons, or fraction thereof, pumped daily, causes an expense for construction of about $350,000, which would consist of a new engine, boilers, enlargement of engine and boiler houses, and an additional force main from the works into the city. Another large expense would be the laying of larger distributing mains throughout the city to carry this increased quantity of water.

The head of water is now none too large, and any attempt to force more water through pipes than is their economical capacity results in loss of head and an increased ratio in the consumption of fuel.

The following table is of interest as showing certain conditions the two years previous to the introduction of meters as compared to the last two years:

COMPARATIVE STATEMENT.

	1887.	1888.	1895.	1896.
Daily average consumption in gallons..................	36,079,068	39,397,716	40,269,731	36,313,340
Daily average consumption per capita...............	195	204	151	130
Total annual consumption.	13,168,859,808	14,388,166,670	14,698,451,954	13,254,369,371
Total consumption through meters..................	65,182,000	91,750,000	2,121,343,600	2,263,413,500
Revenue from unmetered water....................	$316,316.30	$335,140.10	$339,379.69	$321,742.23
Revenue from metered water....................	$6,518.20	$9,175.00	$89,392.72	$84,405.59
Per 1,000 gallons metered water..................	.10	.10	.042	.037+
Per 1,000 gallons unmetered water.................	.024	.023	.027	.029+
No. of families supplied. ..	34,486	36,863	51,426	53,941
No. service connections	32,938	36,609	48,918	50,599
Miles of pipe.............	322	325	501	518
No. of meters.............	About 40	48	3,775	4,584
Actual operating expenses..	$82,723.74	$92,402.59	$107,552.30	$113,445.46
*Estimated population......	184,829	194,996	266,545	279,107

*Population estimated by multiplying families in city by 5.14.

Electrolysis.

During the past year we have had our first experiences with electrolysis, which was confined entirely to service pipes; the mains, as far as we have any knowledge, being still unaffected.

This action occurred in three different localities, and was due to special circumstances in those localities.

On Jefferson avenue, the ten-inch distributing main lies immediately under the street car track and, upon the appearance of electrolysis of the lead service pipes leading therefrom, this was abandoned, in what is called the danger district, and six and eight-inch mains laid inside the curbs by order of the Board.

Consultation was had June 30th with George H. Lothrop, City Electrician Alexander Dow and Chas. W. Ruehle, and much interesting information obtained in regard to electrolytic action upon metals and the conditions necessary to such action.

Prof. C. A. Kent was employed to prepare an opinion as to the legal steps necessary to take to place the responsibility for the destruction of pipes by electrolysis upon the street car companies, which was in brief as follows:

First: The Board has every remedy against anyone injuring water pipes.

Second: It is the right and duty of the Board to protect service connections, notwithstanding the fact that private parties are required to pay for them.

Third: The Court, on a bill in equity, would require construction of double trolleys.

Fourth: The Board would have to prove injury and that it was caused by the company sued.

Fifth: Would have to prove double trolley more effective and cheaper than other means of prevention.

Sixth: Would finally advise Board to consult with officers of street car companies as to the nature and causes of the evil and the proper remedies to apply, and that there should be no resort to legal proceedings until there has been given the fullest consideration to questions of fact involved.

Upon the reception of this opinion, I was instructed to correspond with other cities and obtain information as to their several experiences.

This I complied with, and on Aug. 12 presented to the Board a paper containing the information I had received and the inferences I had drawn from the several experiences presented me.

There was a close similarity in the general conditions of the different cities, which established the fact that the current of electricity, in seeking to find its way back to the power houses, will, where the means of return provided are inadequate, seek the water or gas pipe. In outlying districts, where the potentials of these means of return are necessarily higher, this overflow of electricity from the rails largely prevails. The electricity then passes along the water pipe towards the power house until it reaches a district, adjacent thereto, in which the potential of the rails is less, where it will leave the pipe and pass again to the rails, or through the earth, to the power house.

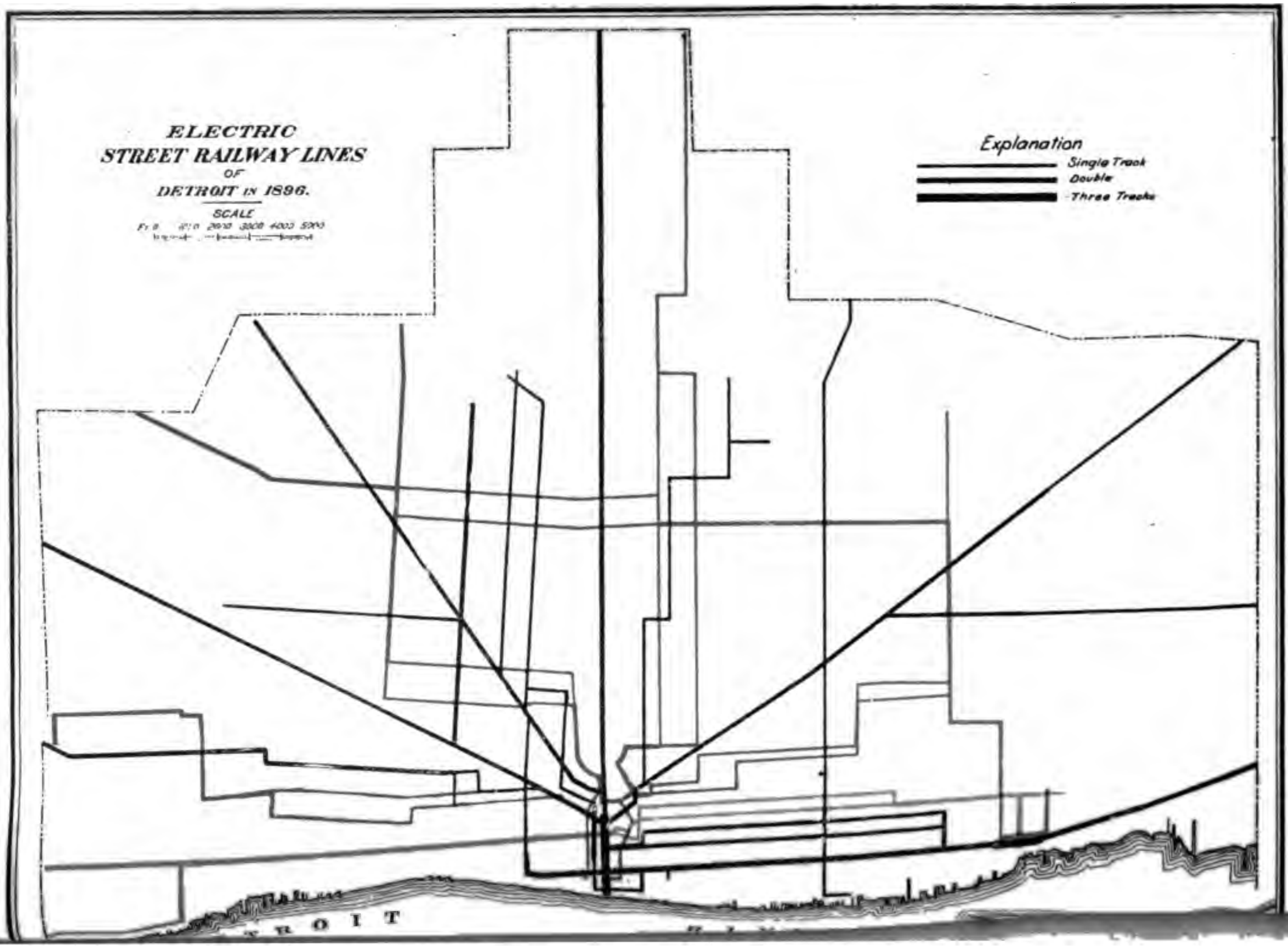
The necessity, first, is to keep the electricity off from the pipes as much as possible in those districts where there is a tendency to overflow from the rails. This can be accomplished by providing a more liberal system of return conductors. The uninterrupted conductivity of the rails should be first insured, an additional feeder of copper wire being sometimes used independent of the rails.

The next step is to arrange special return wires from the pipes to the rails or return cables in what are known as the danger districts, which are almost entirely within a short radius of the power houses.

Pursuant to the above ideas, I had a meeting with Mr. A. B .du Pont, of the Citizens', and Mr. W. E. Davis, of the Detroit Railway Companies, who expressed a willingness to do all that they could to prevent further injuries; and, subsequently, certain measures were introduced, with intent, first, to prevent as far as possible the overflow from the rails in outlying districts, and, second, to provide for the return in the central portions of the city.

The work by the Citizens' Railway Company was performed under the instructions of Mr. A. B. du Pont, the General Superintendent, and under the supervision of their electrician, Mr. C. B. King, who, at my request, has prepared the following very interesting report of these operations and the results therefrom:

In beginning this report, I would first call attention to the relative locations of the several railway systems and their power houses. By referring to Plate, it will be observed that the Citizens' Railway (black lines) and the Detroit Railway (red lines) ramify the city in all directions, while the Fort Wayne



ELECTRIC
STREET RAILWAY LINES
OF
DETROIT IN 1896.

& Belle Isle Railway (green lines) is in only that part of the city near the river. The power houses, represented by small rectangles of the same color as their respective lines, are situated near the river, not in the center of their systems, but at one side of them.

The Fort Wayne & Belle Isle Railway, being the smallest system, and its power house being at quite a distance from the other power houses, will not be considered further in this report.

The Citizens' power house and the Detroit power house are situated very near each other on Atwater street near Riopelle street, the one being a few hundred feet west of Riopelle on the north side of Atwater, and the other on the corner of Riopelle and the south side of Atwater.

When the Detroit System was put down, all the crossings were insulated as perfectly as possible, the intention being to have each system provide for its own return current. The Detroit roadbed consists of C. I. Company's rail, Section 85, No. 814, on wooden ties on concrete foundation. The track is well bonded with 4-0 Chicago bonds around the fish-plates. The Citizens' lines are mostly of Johnson Company's rail, Section 98, No. 289, on steel ties on concrete foundation. This track is bonded with 4-0 U. bonds in the bottom flange of the rail. The Jefferson avenue track from Woodward avenue to Mt. Elliott avenue is electrically welded. The thirty-eight broken joints out of over 4,000 welds have been repaired by placing special fish-plates on them, and then bonded with two or four Chicago bonds, according to their location. As all Citizens' Company's current was to return via this track, it was necessary that it be perfectly bonded, as only electric welding affords. While the broken joints were loose, the conductivity of the track was unaffected, because of one and one-half inch iron cross-bonds every 500 feet, and because of the steel tie construction. The middle track in Woodward avenue, from Jefferson avenue to Michigan avenue, is also electrically welded. Michigan avenue and Woodward avenue being the center of the Citizens' system, it was deemed necessary that there be an extra good return conductor from that point. The negative conductor from the track at Riopelle street and Jefferson avenue consists of 5,000,000 C. M. copper buried in the street. It runs down Riopelle street to the Michigan Bell Telephone Company's man-hole just south of the Grand Trunk Railway tracks. From there, it runs westward to the power house and directly to the negative terminals of the generators.

The nearest Detroit line being at quite a distance from their power house, it was necessary to run aerial negatives. They consist of five 500,000 C. M. cables branching from their negative pole on the north-west corner of Riopelle and Franklin streets.

From there to the negative buss-bar, the negative conductor consists of 7,500,000 C. M. copper buried in the street.

The Michigan Bell Telephone Company have protected their underground cables by connecting them to copper conductors which lead to their man-hole in Riopelle street just south of the Grand Trunk Railway tracks. There they connect to both the Citizens' Company's negatives and to the Detroit Company's negatives.

The lines of the two systems forming such a net work, the power houses being so close together, and their negatives being connected by the Telephone Company's return, makes them, so far the return current is concerned, practically one system. This arrangement was still further perfected when the Detroit power house was shut down and their lines operated from the Citizens' Company's power house.

Early in the summer of 1896, an electrical survey of the city was made along the Citizens' Company's lines. The results were so uniform as to make it quite reasonable to suppose the same conditions existing on the Detroit lines. This survey showed that on Jefferson avenue, from the Water Works to Crane avenue, the pipe was negative; at Crane avenue the pipe became positive less than one volt. Moving westward the difference between the pipe and the rail gradually increased to three and one-half volts (pipe positive) at Bellevue avenue.

Continuing westward, at Beaufait avenue, the pipe was one and one-half volts positive. It gradually increased till, at Riopelle street and Jefferson avenue, it was eight and one-half volts. Along Riopelle street, towards the power house, it increased to nine volts at Franklin and Riopelle street. This was the highest reading. Westward from Riopelle street, the difference decreased to one-sixth volt at Woodward avenue, pipe positive. A few momentary positive readings were found near Second and Third streets on Jefferson avenue.

Going along the Loop Line from Mt. Elliott and Jefferson avenues, the readings decreased so that the neutral points were found near Leib street on Congress street, and near Elmwood avenue on Fort street. All the Congress street track was found to be positive. Throughout all the other parts of the city, the track was found to be positive. At Concord avenue and Jefferson avenue, there was found to be about three volts' difference between the Detroit Company's tracks and the Citizens' Company's tracks, the latter being negative. According to the principle that current flows by the path of least resistance, to the power house, this current flowed through the earth and pipe to the Citizens' track, and thence directly to the power house, rather than back by way of the Detroit track and their negative, which would be a round-about path. To remedy this, a large bond was made between the two Companies' tracks, so as to provide an easier path than the earth and pipes for the current. This reduced the readings in that district east of Beaufait bridge to five-sixth volt at Bellevue, decreasing till the neutral point is found at Helen avenue.

When the Water Commission put their new mains in on both sides of Jefferson avenue from Antoine street to Orleans street, the cross-mains were connected by wire to the track directly above. The abandoned main, parallel with and directly beneath the track, was also connected by wire to both the cross-mains, and to the track. The above connections were made, as follows:

Riopelle street............	4 taps	11 4-0 wires	2,327,600 C. M.
Russell street.............	1 "	2 " "	423,200 " "
Rivard street.............	5 "	5 " "	1,058,000 " "
Hastings street...........	4 "	3 " "	634,800 " "
Antoine street............	4 "	3 " "	634,800 " "
Total			5,078,400

These connections perceptibly changed the readings of the next survey. The neutral point was brought from Woodward avenue to Brush street, and the intensity of the readings all along Jefferson avenue was also greatly reduced.

At Beaufait ave., it was about one-sixth volt, formerly 1 1-3.

At Dequindre, 2½, formerly 7½.

At Riopelle, 1½, formerly 8½.

At Beaubien, 1-6, formerly 1 2-3.

At Riopelle and Franklin, 5, formerly 9.

There was also a corresponding decrease at each point between those mentioned.

The abandoned main, directly under the track, was electrically connected to the cross-mains still in use; and they, the cross-mains, were connected to the track, the theory being that, the old main being nearest the track, towards which the current tends to flow, it would be a trap where electrolysis might occur without damage. The current would flow along the mains in service through the wire connections into the old main, and from there through the earth to the rail. The new mains and all service connections being so much greater distance from the track than the old main, there need now be no fear of trouble.

Connections were also made in Riopelle street between the water-mains and the negative wires wherever they cross, as follows:

Jefferson Avenue, 1 tap, a and 3-0 wires........	503,415 C. M.
Woodbridge Street, 1 tap, 3 and 3-0 wires........	503,415 C. M.
Franklin Street, 1 tap, 3 and 3-0 wires........	503,415 C. M.
Total	1,510,245 C. M.

As the readings were still too high on Jefferson avenue, east of Dequindre street, connections were made between the cross-mains and the track, as follows:

Dequindre, 1,500,000 C. M. Cable	500,000 C. M.
St Aubin, Dubois, Chene and Campau, 3 3-0 wires each	2,013,660 C. M.
Total	2,513,660 C. M.

The readings are now reduced to less than an average of one-half volt on Jefferson avenue from Dequindre street to Beaufait avenue; and as the Jefferson avenue main is south of the south curb-line and most of the north-side service pipes come from Larned street, trouble can occur to only a limited extent, if at all. Upon investigating trouble reported on Woodbridge street and on Franklin street between Rivard and Riopelle streets, it was found that several lead service pipes were injured near their extremities; that is, the end toward the power house. This would indicate that the current had flowed along the main, along the service pipe to near the end, and then through the earth to the power house. This trouble became evident shortly after the connections were made in Riopelle street. After the above trouble was noticed, connections were made between an aerial negative and the mains in Woodbridge street and in Franklin street at Rivard. Also, between an aerial negative and the mains in Riopelle street at Larned, at Congress and at Fort streets. At Congress street, the twenty-four inch main is tapped. Tests were made in the square south of Jefferson avenue and between Rivard street and Riopelle street after the above connections were made. These tests were made between the water-pipes and a copper rod driven into the earth. All these tests showed the tendency of flow to be from earth to pipe, so that it is now fair to suppose that there will be no further trouble unless the pipes have been already so badly injured that they are liable to leak at most any time.

The size of the copper negative from the Grand Trunk Railway tracks and Riopelle street to the power house has been increased 3,000,000 C. M., so that the total size of the negative conductors from the track to the power house is a little over 7,500,000 C. M.; which is amply sufficient to carry the output of the power house. When this 3,000,000 C. M. wire was being put down there was some objection on the part of the owners of the service pipes to having them connected to this negative, but this objection must be overcome in future cases of trouble. As these connections are made only where the volt-meter indicates that the direction of the current is from the pipe, there can be no damage done to the pipe, because the wire connection offers an easier path for the current than the earth. The pipes are injured only where the current leaves them, and passes off through damp earth to some

better conductor than the pipe. Now, if this better conductor is attached directly to the pipe, the current will pass off without causing injury. Electrolysis can occur only where the earth is damp and where it contains some kind of salt solution. Absolutely pure water is almost a non-conductor, but when some saltine compound or acid is added, it becomes a good conductor, and electrolysis will occur on the positive terminal in the fluid. If the terminals in the fluid are connected by wire, the electrolyic action will cease. This same principle applies with regard to water-pipes and tracks. Where the pipes are positive and the rails on return wires are negative, electrolysis will occur; but when the two are connected by wire, the action ceases. In this city, the dangerous district (where the flow of current is from pipes to rail) is confined to a small area around the power house, and along the Jefferson avenue track as before stated. As ample connections have been made at the most advantageous points within this district, no further serious damage is anticipated.

Conclusion.

To recapitulate the changes and improvements of the last few years: First, pressures are equalized and increased 15½ feet throughout the city. Water rates have been reduced to such an extent as to make an annual reduction in the income of the Board from this source of $128,000. The quantity of water pumped annually has not increased in nine years, while the population has increased 100,000, with a growth in the manufacturing and business interests of over 56 per cent. The expenses of pumping in 1887 of $57,000 has been reduced in 1896 to $53,000 through the adoption of economical methods. In addition, the bonded indebtedness of the Board has been decreased during this period $200,000.

Our present condition is this: A perfectly equipped plant, with a maximum pumping power of over 100,000,000 gallons capacity daily, and a pipeage system as complete as it is possible to make it. Comparatively speaking, there are no complaints of service or treatment, and the water rates are the cheapest in the world.

In conclusion, I wish to say that I but seldom speak personally of the subordinate employees of the Board in my annual report, unless, as in the case of Mr. Gould, there is some special reason for it. Any one as familiar as I am with the conduct of the employees, from the heads of departments down to the men who are engaged in the repairing of leaks at $1.75 per day, will be impressed with the earnestness and the desire to do well, that characterizes every man that has served the Works any length of time. I think our fellow-citizens who are brought in contact with these employees of your honorable body will justify me in the above deserved encomium.

All of which is respectfully submitted.

L. N. CASE,
General Superintendent.

Water Works Bonds.

The following table gives the entire history of the issue and redemption of the bonds of the Board:

No. of Issue.	Act of	Issued.	Payable.	Amount.	Rate of Interest.	Redeemed.	Out-standing
1st	1853	Aug. 1, 1853	Aug. 1, 1883	$100,000	7cts.	$100,000	....
“	“	“ “	Aug. 1, 1878	100,000	7 “	100,000	....
“	“	“ “	Aug. 1, 1873	50,000	7 “	50,000	....
2nd	1855	Aug. 1, 1855	Aug. 1, 1890	100,000	7 “	100,000	....
“	“	June 12, 1855	Aug. 1, 1885	100,000	7 “	100,000	....
“	“	“ “	Aug. 1, 1880	50,000	7 “	50,000	....
3rd	1857	Aug. 1, 1858	Aug. 1, 1893	150,000	7 “	150,000	....
“	“	Aug. 1, 1867	Aug. 1, 1887	100,000	7 “	100,000	....
4th	1869	Feb. 1, 1870	Feb. 1, 1900	100,000	7 “	....	100,000
5th	“	Aug. 1, 1872	Aug. 1, 1902	50,000	7 “	.... ..	50,000
6th	“	Aug. 1, 1873	Aug. 1, 1903	50,000	7 “	....	50,000
“	1873	Feb. 1, 1874	Feb. 1, 1904	50,000	7 “	9,000	41,000
7th	1869	Aug. 1, 1874	Aug. 1, 1904	50,000	7 “	6,000	44,000
“	1873	“ “	“ “	200,000	7 “	.... ..	200,000
“	“	June 1, 1875	June 1, 1905	150,000	7 “	1,000	149,000
“	“	June 1, 1876	June 1, 1906	200,000	6 “	1,000	199,000
“	“	Sept. 1, 1880	Sept. 1, 1899	100,000	4 “	....	100,000
“	“	April 1, 1881	April 1, 1897	100,000	4 “	....	100,000
“	“	Dec. 1, 1881	Dec. 1, 1896	50,000	4 “	50.000	....
“	“	Jan. 10, 1895	Jan. 10, 1925	100,000	4 “	. .	100,000
				$1,950,000		$817,000	$1,138,00

Assessments, 1896-7.

Dist.	WARDS.	FAMILIES.			Increase or Decrease.	Vacant Tenements.	ASSESSMENT.		
		Supplied.	Not Supplied.	Whole Number.			1896-7.	Decrease.	Transfer'ed to Meter Rolls.
1	Ninth.......	5,444	12	5,456	108	85	22,916	**4,958**	523
	Fifteenth. .	3,174	43	3,217	374	58	17,307	**1,240**	241
	Total......	8,618	55	8,673	482	143	40,223	**6,198**	764
2	Eleventh ...	3,681	5	3,686	177	74	17,143	**3,316**	285
	Thirteenth..	2,671	7	2,678	149	58	12,885	**2,119**	302
	Total......	6,352	12	6,364	326	132	30,028	**5,435**	587
3	First......	2,675	3	2,678	118	126	22,639	**2,418**	638
	Seventh	3,402	18	3,420	103	121	14,700	**3,681**	1,120
	Total......	6,077	21	6,098	221	247	37,339	**6,099**	1,758
4	Third... ...	3,302	8	3,310	46	79	15,986	**3,195**	725
	Fifth	3,879	7	3,886	101	92	17,579	**3,905**	696
	Total......	7,181	15	7,196	147	171	33,565	**7,100**	1,421
5	Second	2,149	3	2,152	108	126	23,100	**949**	844
	Sixth.....	3,710	11	3,721	135	98	21,980	**2,508**	462
	Total.. ..	5,859	14	5,873	243	224	45,080	**3,457**	1,306
6	Tenth.......	4,278	7	4,285	184	107	22,030	**3,064**	356
	Fourteenth.	2,453	26	2,479	149	58	12,165	**1,548**	186
	Total	6,731	33	6,764	333	165	34,195	**4,612**	542
7	Fourth.....	3,149	3	3,152	42	148	22,631	**2,624**	871
	Twelfth	3,376	2	3,378	203	142	16,468	**2,352**	266
	Total......	6,525	5	6,530	245	290	39,099	**4,976**	1,137
8	Eighth......	3,569	3	3,572	169	96	20,311	**2,697**	507
	Sixteenth...	3,029	202	3,231	349	62	13,892	**971**	181
	Total	6,598	205	6,803	518	158	34,203	**3,668**	688
Aggregate		53,941	360	54,301	2,515	1,530	293,732	**41,545**	8,203

FINANCIAL REPORT BY THE SECRETARY

For the Year 1896.

Receipts.

Water Rates Account.—	
Rates paid	$406,147 82
Percentage Account.—	
From delinquents	7,339 82
Penalties for shutting off	447 00
Plumbers' License Account.—	
Paid for licenses	565 00
Service Connections Account.—	
Labor and material	5,389 95
City of Detroit Account.—	
Tax levy	72,554 00
Repairing Leaks Account.—	
Labor	129 01
Office Account.—	
Sale of material	3 00
Iron Pipe Account.—	
Labor and materials	29,939 30
Bonus paid for extensions	201 91
Hurlbut Fund Account.—	
Payments from trustees	4,500 00
Rebate	65
Real Estate Account.—	
Rentals	2,350 00
Meters Account.—	
Sale of material	24 50
Interest Account.—	
On deposits, general account	3,015 94
On deposits, sinking fund	780 00
Horse and Wagon Account.—	
Sale of horse, phaeton, etc	150 00
Pumping Works Account.—	
Sale of material	250 00
Pumping Water Account.—	
Ice and material	104 43
Service Extension Account.—	
For service extensions	3,893 78
Total receipts	$537,786 11

Expenditures.

FOR CONSTRUCTION.

Iron Pipe Account.—

Superintendent and clerks	$ 17,137 48	
Labor	103,890 32	
Iron pipe	51,800 57	
Special castings	8,228 27	
Tools and repairing of	813 80	
Valves	5,090 76	
Lumber	1,357 14	
Coal	281 86	
Oil	114 87	
Packing	417 84	
Lead	5,618 47	
Paint, etc	126 99	
Repairs and material for	462 75	
Repaving	5,142 70	
Street car and toll tickets	336 00	
Livery	51 50	
Wagon and harness supplies and repairs	500 82	
Horses expense	1,735 68	
Farrier	459 05	
Materials	1,902 03	
Cement, sand and brick	2,100 72	
Stationery, books, etc	255 20	
Medical services	745 53	
Refund	65 50	
Veterinary services	122 49	
Pasture, two horses	10 00	
Poundmaster	1 00	
Insurance	7 00	
Gate boxes and wells	2,378 00	
Freight, express and telegrams	12 11	
Boulevard fountains	482 99	
Extra services	141 94	
Injuries	5,011 25	
Bicycles	200 00	
Old hose and hydrants	176 00	
Crushed stone	137 41	
		$217,316 04

Pumping Works Account.—		
Labor	$ 2,530 42	
Pipe, fittings, etc	675 65	
Tug services	7 00	
Hauling	21 00	
Toilet rooms	1,153 44	
Paving	3,331 44	
New governor	246 68	
Material—Stationery, etc	30 87	
Piston rings	249 16	
Iron posts and gate spindles	197 50	
Painting boiler rooms	605 64	
Advertising	24 43	
Remodeling coal sheds and boiler house	7,032 02	
Repairs	165 76	
Gate valves	696 50	
Canal—Dredging and bracing embankment	1,700 00	
New boilers	18,642 25	
Coal handling apparatus	10,290 00	
Electric light plant	1,126 89	
		$48,726 65
Meter Account.—		
Superintendent and labor	$ 6,340 08	
Meters	10,435 76	
Freight and express	60 61	
Specials and fittings	553 43	
Horse board and shoeing	410 53	
Repairs to harness and vehicles	117 56	
Street car tickets	10 00	
Hauling	20 50	
Material—Brass solder, lumber, etc.	352 43	
Tools and repairing of	22 71	
Printing, stationery and postage	35 75	
Meter wells	39 00	
Repairing pavement	3 03	
Bicycle	25 00	
Insurance	3 50	
		$18,429 89
Real Estate, Revenue and Expense Account.—		
Labor	$ 260 59	
Insurance	385 71	
Plastering	177 94	
Material—Lumber, paint, etc	221 64	
Papering and painting	337 90	
Repairs—Roof, furnace and chimneys	115 57	
		$1,499 35

Engineering Account.—		
Civil engineer and assistants	$ 11,232 29	
Material, instruments, etc	938 10	
		$12,170 39
Horse and Wagon Account.—		
Horses	$ 325 00	
Harness	50 00	
Vehicles and parts thereof	565 50	
		$940 50
Office Furniture and Fixture Account.—		
Furniture and fixtures	$ 343 62	
		$343 62
Aggregate		$299,426 44

OPERATION AND MAINTENANCE.

Office Account.—		
Secretary, assessors and clerks	$ 30,194 15	
Watchman and janitors	1,994 75	
Printing and binding	1,378 45	
Advertisements and subscriptions	114 93	
Supplies—Soap, matches, etc	186 10	
Supplies—Stationery, etc	248 89	
Furniture and fixtures	29 83	
Legal services	2,289 30	
Extra services	726 26	
Fuel	1 92	
Light	177 36	
Postage and telegrams	257 66	
Ice	33 00	
Street car tickets	30 00	
Horse board	234 75	
Farrier	33 50	
Harness and buggy repairs	61 75	
Horse, harness and buggy supplies	23 55	
Express charges	45	
Livery	3 50	
Telephone rent	744 26	
Premium on guaranty bonds	537 50	
Street sprinkling	47 50	
Electric light repairs	122 32	
Disinfectant	8 10	
Counterfeit money	15 03	
Auxiliary fire alarms	20 00	
Safe rental	10 00	
Atlases	100 00	
Badges	475 00	
Expenses to Indianapolis—Gen. Supt. and Supt of Meters	66 90	
		$40,166 71

Pumping Water Account.—

Engineers and firemen	$ 19,419 79	
Consulting engineer	1,000 00	
Fuel oil	10,825 44	
Coal	12,610 33	
Handling coal	996 88	
Engine oil and waste	408 93	
Boiler and machine repairs	540 75	
Supplies—Soap, polish, etc	120 54	
Supplies—Valves, gaskets, packing, etc.	191 46	
Electric light supplies, etc	183 42	
Street car toll tickets and telegrams	14 18	
Medical service	1 00	
Car rental	8 00	
Ice	8 25	
Farrier	6 30	
Horse expense	144 64	
Boiler inspection	48 00	
Cartage	6 13	
Expenses to Chicago and Saginaw—Chief Engineer	25 90	
Alarms	64 00	
Stationery	1 60	
		$46,625 54

Percentage Account.—

Labor	$ 2,560 00	
		$2,560 00

Repairing Leaks Account.—

Labor	$ 13,354 71	
Wagon and harness repairs	96 02	
Horse expense	867 84	
Farrier	132 00	
Street car and toll tickets	61 00	
Repairing tools	35 46	
Tools and materials	213 17	
Repairing pavement	391 82	
Deacon meter	138 77	
Permits	1 00	
		$15,291 79

Service Connections Account.—

Labor	$ 8,450 13	
Buggy and harness repairs	322 50	
Cocks and valves	1,557 68	
Farrier	55 75	
Toll tickets	5 00	
Refund to plumber	9 23	
Material and repairs	213 69	
Horses expense	289 28	
		$10,903 26

Inspection Account.—		
Labor	$ 4,670 00	
		$4,670 00
Meter Repairs and Expenses Account.—		
Fittings, etc.	$ 1,414 46	
		$1,414 46
Aggregate		$121,631 76
Bonded Indebtedness Account.—		
Bonds paid	$ 50,000 00	
		$50,000 00
Interest Account.—		
Interest paid	$ 59,455 00	
		$59,455 00
Hurlbut Fund Account.—		
Superintendent, librarian and labor	$ 7,309 16	
Plants, trees, flowers, fertilizers, etc.	981 46	
Tools, material and repairs	415 82	
Street car tickets	10 00	
Farrier	3 45	
Harness repairs and supplies	2 15	
Horse expense	144 64	
Medical services	19 00	
Settees	227 50	
Sodding	296 40	
Expenses to Painesville—Superintendent of Grounds	12 60	
Subscription	8 00	
		$9,430 18
Service Extension Account.—		
Labor	$ 1,774 08	
Lead pipe, stop boxes, curb cocks and solder	1,969 91	
Tools and material	5 98	
Inspection	73 75	
Permits	1,380 00	
		$5,203 72

RECAPITULATION.

Construction expenditures	$299,426 44
Operation and maintenance expenditures	121,631 76
Bonded indebtedness	50,000 00
Interest	59,455 00
Hurlbut fund	9,430 18
Service extensions	5,203 72
Aggregate	$545,147 10

RECEIPTS OF WATER RATES BY DISTRICTS.

YEAR.	1st District Wards 9 and 15.	2d District Wards 11 and 13.	3d District Wards 1 and 7.	4th District Wards 3 and 5.	5th District Wards 2 and 6.	6th District Wards 10 and 14.	7th District Wards 4 and 12.	8th District Wards 8 and 16.	METERS Jan. 1, '96 to Jan 1, '97.	AGGREGATE.
1890-1	$ 15 00	....	....	....	....	....	....	....	....	$ 15 00
1891-2	15 00	....	....	....	....	....	....	....	....	15 00
1892-3	15 00	....	$ 11 50	....	....	....	....	....	....	26 50
1893-4	26 25	$ 37 00	41 00	$ 14 50	$ 5 50	$ 30 10	$ 7 34	$ 32 25	....	193 94
1894-5	70 75	38 15	885 50	80 25	38 90	106 65	74 88	130 75	....	1,425 83
1895-6	23,617 70	17,735 54	22,321 14	20,528 29	24,969 05	20,284 03	22,704 82	19,948 42	....	172,108 99
1896-7	20,955 67	15,233 39	19,016 55	16,877 67	21,811 84	17.014 29	19,557 11	17,490 45	$84,405 59	232,362 56
Total..	$44,715 37	$33,044 08	$42,275 69	$37,500 71	$46,825 29	$37,435 07	$42,344 15	$37,601 87	$84,405 59	$406,147 82

Actual Operating Expenses.

The actual operating expenses are the foregoing expenditures for operation, less the credits by cash received for said expenditures, and are as follows:

Office account	$ 40,166 71	
Less receipts	3 00	$40,163 71
Pumping water	46,625 54	
Less receipts	104 43	46,521 11
Repairing leaks	15,291 79	
Less receipts	129 01	15,162 78
Service connections	10,903 26	
Less receipts	5,389 95	5,513 31
Inspection		4,670 00
Meter repairs and expenses		1,414 46
Total		$113,445 37

All of which is respectfully submitted.

L. N. CASE,
Secretary.

Certificate of Auditor.

To the Board of Water Commissioners:

Gentlemen—I furnish herewith a consolidated statement of the financial operations of the employees of the Water Board for the year 1896:

H. S. STARKEY, METER CLERK.

I have examined the accounts of the Meter Clerk from July 1st, 1895, to July 1st, 1896. Meter bills amounting to $91,771.19 were collected, and same passed in full to Receiving Clerk.

J. E. LONG, PERMIT CLERK.

The total receipts from service cocks, sleeves, valves and plumbers' licenses from July 1st, 1895, to July 1st, 1896, as proven by examination of receipts issued, was		$5,245 50
Receipts from delinquent taxes were:		
Year.		
1885-6	$ 2 50	
1886-7	5 00	
1890-1	18 50	
1891-2	17 50	
1892-3	61 25	
1893-4	363 85	
1894-5	3,053 65	
		3,522 25
Total		$8,767 75

The books of the Receiving Clerk show that amount above has been received in full.

Consolidated Statement.

ASSESSORS DISTRICTS 1 TO 8 INCLUSIVE.

Assessments, 1895-6, Districts 1 to 8	$335,277 00	
Gains (increased assessments)	17,270 33	
Cash paid Receiving Clerk		$342,746 33
Losses (assessments reduced)		7,947 00
Delinquent rates		1,851 75

District No. 3—Short	$ 50		
District No. 7—Short	75		
District No. 8—Short	2 25		3 50
District No. 6—Over		1 25	
		$352,548 58	$352,548 58

MEMORANDUM.

Districts Nos. 1, 2, 4, 5 .... **Balanced**

GEO. E. KUNZE, RECEIVING CLERK.

The total receipts of the Receiving Clerk from all sources from January 1, 1896, to January 1, 1897, were as follows:

January	$ 72,918 32	
February	16,729 37	
March	28,136 72	
April	68,627 78	
May	18,030 25	
June	26,180 32	
July	90,586 45	
August	65,859 03	
September	27,260 32	
October	61,507 05	
November	18,522 11	
December	43,428 39	
	$537,786 11	
Cash on hand January 1, 1896	6,562 80	
		$544,348 91

With bank deposits as follows:

January	$ 69,892 44	
February	24,143 70	
March	23,145 69	
April	66,628 46	
May	24,940 42	
June	21,813 55	
July	88,115 53	
August	72,512 21	
September	22,619 42	
October	60,499 61	
November	24,175 48	
December	39,876 64	
	$538,363 15	
Cash on hand January 1, 1897	5,985 76	
		$544,348 91

The sources of the foregoing receipts were as follows:

Water rates		$406,147 82	
Percentage	$ 7,339 82		
Shuts	447 00		
		7,786 82	
Service connections	5,229 75		
Service connections, material sold	160 20		
		5,389 95	
Plumbers' license		565 00	
City of Detroit (tax levy)		72,554 00	
Iron pipe, material sold	29,882 40		
Iron pipe bonus	201 91		
		30,084 31	
Repairing leaks, material sold		129 01	
Pumping water		104 43	
Meter account		24 50	
Real estate, revenue and expense, rents		2,350 00	
Interest account		3,795 94	
Horse and wagon (horse sold)		150 00	
Hurlbut Fund		4,500 65	
Pumping Works, material sold		250 00	
Office, material sold		3 00	
Service extension		3,893 78	
Horse expense		56 90	
			$537,786 11

CASH STATEMENT YEAR 1896.

Jan. 1, 1896. Dr.	
Cash on hand	$ 6,562 80
Commercial National Bank, balance General Fund	43,555 49
Commercial National Bank, balance Secretary's Fund	1,000 00
Receipts, 1896	537,786 11
	$588,904 40

Jan. 1, 1897. Cr.	
Cash on hand	$ 5,985 76
Commercial National Bank, balance General Fund	36,771 54
Commercial National Bank, balance Secretary's Fund	1,000 00
Disbursements, 1896	545,147 10
	$588,904 40

I certify to the correctness of the Receiving Clerk's accounts as above.

Disbursements have been made through the Secretary's office as follows:

January	$ 33,704 77	
February	34,109 35	
March	30,922 43	
April	26,969 12	
May	23,965 61	
June	56,068 12	
July	48,200 87	
August	50,647 43	
September	64,537 30	
October	48,591 56	
November	97,338 99	
December	30,091 55	
		$545,147 10

The above disbursements were debited to the following ledger accounts:

Iron pipe	$215,908 56	
Meters	18,140 61	
Service connections	10,613 98	
Engineering	12,170 39	
Office	40,021 96	
Pumping water	46,480 90	
Repairing leaks	14,423 95	
Meter repairs and expenses	1,414 46	
Percentage	2,560 00	
Inspection	4,670 00	
Hurlbut Fund	9,285 54	
Interest	59,455 00	
Horses and wagons	940 50	
Office furniture and fixtures	343 62	
Real estate, revenue and expenses	1,499 35	
Horse expense	3,287 91	
Pumping works	48,726 65	
Service extension	5,203 72	
Bonded indebtedness	50,000 00	
		$545,147 10

In connection with above disbursements, I desire to state that I have made a careful examination of all vouchers monthly before the passage of same by your honorable body, and hereby certify to the correctness of the foregoing.

Respectfully submitted,

J. A. M. MORETON,
Auditor.

REPORT OF THE CIVIL ENGINEER.

Detroit, January 16, 1897.

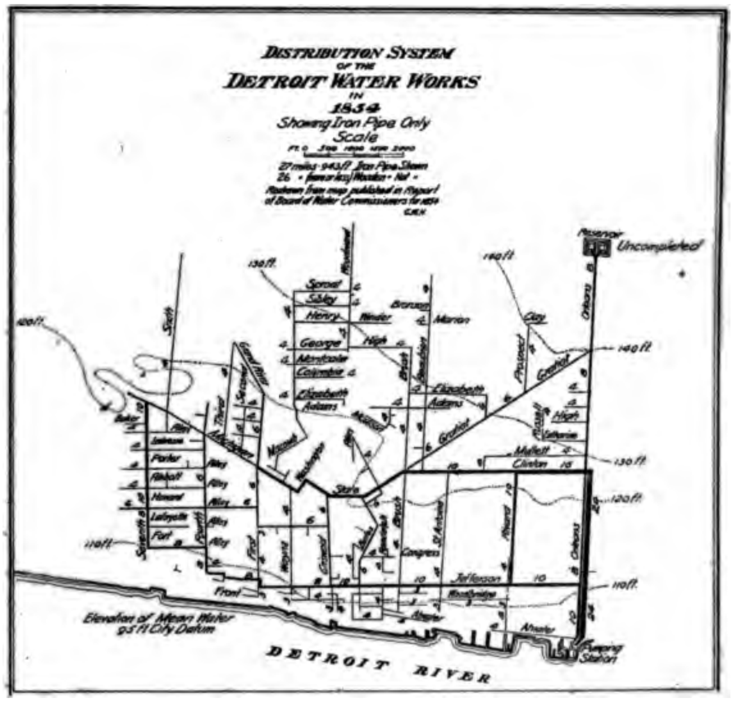
To the Honorable Board of Water Commissioners:

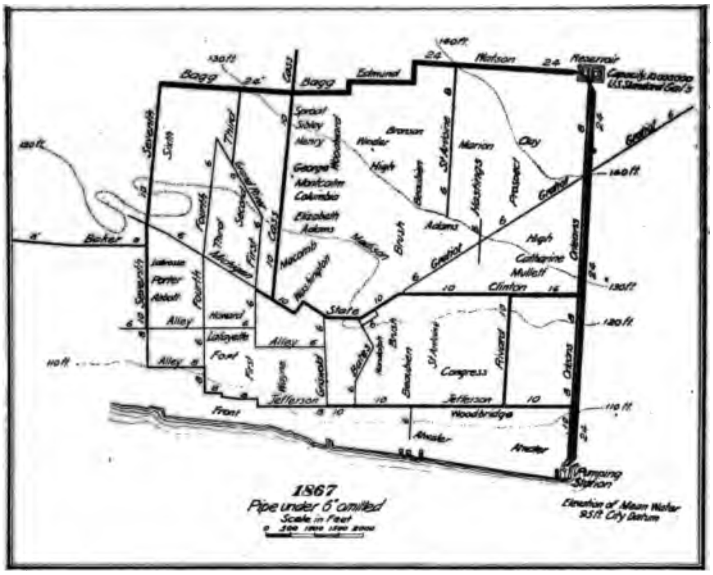
The completion of the new 30-inch main connecting with the old mains of the same size in Scott street and Orleans street, put in service to-day, practically finishes the rearrangement of the distribution system as recommended in outline by your Civil Engineer in March, 1893, and adopted on more specific recommendations, from time to time, by resolutions of your honorable body. Until our system is extended beyond its present boundaries, which are now practically coincident with those of the city, nothing is likely to be required beyond the laying of short lines for the improvement of purely local conditions, except in the easternmost part of the city.

As the system stands to-day, in spite of the fact that Detroit is of large area in comparison with its population, it is doubtful if any city in America supplies a greater proportion of its inhabitants with water. According to the inspection in July last, out of a total of 54,301 families resident within the city limits, 53,900, or more than 99 per cent., were supplied with water from our Works.

The rapid growth of the suburbs, however, indicates that extensions may soon be called for into outlying territory on any side. Those are already completed for the supply of the village of Highland Park, to the north of us, and the large manufacturing interests locating in Delray render it certain that service will be demanded soon in that direction. On the east, Grosse Pointe at present operates its own system, but the distance between the terminus of our

Plate 1.


DISTRIBUTION SYSTEM
OF THE
DETROIT WATER WORKS
IN
1854
Showing Iron Pipe Only
Scale
Ft. 0 500 1000 1500 2000
27 miles 943 ft. Iron Pipe Shown
26 " (more or less) Wooden " Not "
Redrawn from map published in Report
of Board of Water Commissioners for 1854
G.R.H.
Reservoir
Uncompleted
130 ft.
140 ft.
120 ft.
110 ft.
Woodward
Sproat
Sibley
Henry
Winder
Bronson
Marion
High
George
Montcalm
Columbia
Elizabeth
Adams
Clay
Orleans
Gratiot
Prospect
Beaubien
Brush
Russell
High
Catharine
Mullett
Clinton
Sixth
Baker
Abbott
Howard
Lafayette
Fort
Porter
Seventh
Fourth
Third
Second
Michigan
Alley
First
Wayne
Griswold
Macomb
Washington
State
Congress
St. Antoine
Hazard
Jefferson
Woodbridge
Atwater
Front
Elevation of Mean Water
95 ft City Datum
Pumping
Station
DETROIT RIVER


140 ft.
130 ft.
Bagg
24"
Cass
Bagg
Edmund
24
Watson
24
Reservoir
Capacity
U.S. Standard Gal's
Seventh
Sixth
Third
Sproat
Sibley
Henry
Winder
Bronson
Marion
Clay
St. Antoine
Hastings
Prospect
George
Woodward
Montcalm
Columbia
Elizabeth
Adams
Gratiot
High
Catharine
Mullett
Clinton
Orleans
Beaubien
Brush
Madison
Macomb
Washington
Baker
Porter
Abbott
Fourth
Second
Michigan
First
Howard
Alley
Lafayette
Fort
State
Congress
Hazard
Wayne
Griswold
Jefferson
Woodbridge
Atwater
Front
120 ft.
110 ft.
Pumping
Station
1867
Pipe under 6" omitted
Scale in Feet
0 500 1000 1500 2000
Elevation of Mean Water
95 ft. City Datum

line on Jefferson avenue and theirs on the same thoroughfare is only about two miles. During the past summer our main on Gratiot avenue was extended to the French Road, and immediately east of the city limits, north of Mack avenue, extensions have been going on in the adjacent subdivisions for the past two years.

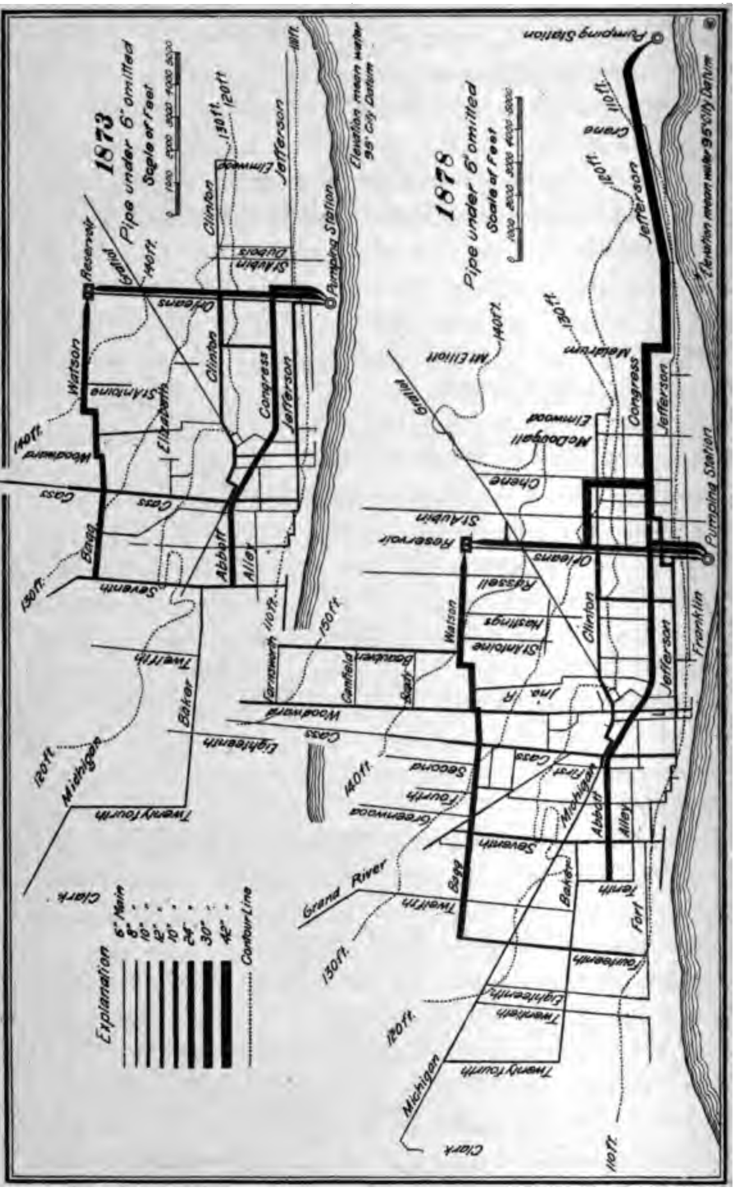
In view of all these facts, it seems proper at this time to review the growth of our Works during the last four decades, as seen from the standpoint of the Engineer, and to indicate the probable lines of extension to be followed in the early future.

The Growth of the System.

A map published in the Report of the Board of Water Commissioners for 1854, which is reproduced in Plate I, page 52, shows that, up to that time, the system had been a combination of direct pressure and elevated tank, the pumping station and tank being at the foot of Orleans street, where they had been established immediately upon the purchase of the old Works from the Hydraulic Company. From the original establishment of Works in this city, the system had been the same combination, and this tank, constructed in 1840 and put into service in 1844, was not discontinued until 1866. Although the reservoir near Erskine street, now dismantled, is shown on this map, the Report states that only about one-third of the work upon it was completed at this time, and not until the fall of 1857 was it brought into use. Its total storage capacity is given in the Report for 1860 as 10,000,000 gallons, and its top water line as fifty feet above the intersection of Woodward and Jefferson avenues. The average daily consumption in 1860 is given as 2,383,661 gallons, so that the reservoir held about four days' supply for the city. From 1857 to 1872 the Works were operated practically as a reservoir system, the water being pumped into the reservoir through a 24-inch main on Orleans street, and, flowing out through a similar main on Watson street, was distributed to the city by smaller lines in the north and south streets, connecting to the latter. Under this arrangement, although at times a portion of the water was supplied directly to the city through the ten-inch line on Jefferson avenue, abandoned the past season, and the sixteen-inch line on Clinton street, it was always possible to shut down the pumps for a limited interval and take the supply wholly from the reservoir. By 1869 it became evident that the city was outgrowing its Works, and at the same time some agitation was commenced favoring the removal of the pumping station to a point assumed to be less liable to afford a contaminated supply. The distribution, at this time, had been extended, as shown in the lower half of Plate I, page 52, and an increase in pumping machinery and reservoir capacity was proposed, the daily consumption having, by that time, reached, on several occasions, practically the limit of the storage, so that the engines had to be run continually to keep up the supply. In a report submitted at this time by William J. McAlpine, C. E., the construction of a new reservoir was recommended near the old one, and of small reservoirs or elevated tanks at some other points, particularly in the vicinity of the intersection of Bagg and Seventh streets, where the pressure was then deficient at times. Mr. McAlpine also recommended the purchase of a new engine. The last-named recommendation, only, was carried out, and it appears that at the time the report was made an engine was under contract. In 1872, following partially a suggestion, but not a recommendation, of Mr. McAlpine, a 24-inch main was laid from the Pumping Station into the heart of the city, through Orleans and Congress streets, upon the completion of which the plant was changed practically from reservoir to direct pressure, and, although the reservoir continued in service, it was only of secondary importance, as rather more than half of the water used was supplied to the city direct. The Works as they were in 1873 are shown on Plate II, page 56. It is to this dual character of the system, which lasted for fourteen years, during which the city made most rapid growth, that many of its present anomalies are due. The principles governing the supply of water by direct pressure are in some respects different from those where a reservoir is used, although, starting at the engine in one case and the reservoir in the other, the laws would be the same, but it will never be possible to get satisfactory service from a system that has been converted from the reservoir to the direct pressure type by merely connecting the supply and discharge mains at the reservoir and using the two as a continuous distributing main.

Looking at the conditions a quarter of a century later, it almost seems that the adoption of the recommendation of Mr. McAlpine in 1869 to establish small local reservoirs at various points about the city where pressure was deficient, would have been a more economical policy than the one pursued of laying large mains for this purpose, especially as the outcome has been that many of the mains would be better laid elsewhere, or of different size, for the present and probable future conditions of operation. Mr. McAlpine, however, as well as his contemporaries and some of his successors, failed to appreciate that a large portion of the system must ultimately be operated under direct pressure. But engineers, like other professional men, have been known to disagree, and it is a very open question whether the abandonment of the reservoir in 1886 was the best solution of the existing difficulties. It is proper to say that the decision to abandon it was only arrived at after extensive study on the part of the officials of the Works and the reference of the matter to Mr. Dewitt C. Cregier of Chicago, who had been for a number of years at the head of the Department of Public Works of that

Plate II.


1873
Pipe under 6" omitted
Scale of Feet
Elevation mean water 95' City Datum
Pumping Station
Reservoir
1878
Pipe under 6" omitted
Scale of Feet
Elevation mean water 95' City Datum
Pumping Station
Reservoir
Explanation
6" Main
8"
10"
12"
16"
24"
30"
42"
Contour Line
Jefferson
Congress
Clinton
Orleans
Watson
St. Antoine
Woodward
Cass
Bagg
Seventh
Twelfth
Baker
Michigan
Twenty Fourth
Clark
Grand River
Abbott
Alley
Fort
Fourteenth
Eighteenth
Twentieth
Grand
Elmwood
Mt. Elliott
Meldrum
Chene
St. Aubin
Russell
Hastings
Franklin
140 ft.
130 ft.
120 ft.
110 ft.
150 ft.

city. Of four alternative plans for the improvement of the system at that time, prepared and submitted by the Superintendent of Extension, Mr. Cregier endorsed the one which was adopted, and as a result the Works were deprived of what might have been a very valuable reserve in case of the crippling of an engine or the breaking of a force main; but during the decade that has elapsed no serious consequences have ensued, and there appears to have been but two or three occasions when it would have been of possible service. With the growth of the system and the establishment of the present, and abandonment of the old Works, covering the period from 1874 to 1881, the reservoir had yearly become of less importance, and in 1886 it had undoubtedly become a detriment, rather than a benefit, from the manner of its connection to the remainder of the system.

In the earlier history of the Works it was not expected that a very extensive growth would take place northward on Woodward avenue, and the plan was to supply the center of town by direct pressure with an emergency connection to the reservoir, controlled by a balanced valve, and to supply the territory west and south of the reservoir from it. To this end, the Watson street main was extended from time to time to the low western territory along Michigan avenue, which was proper as long as the reservoir remained in service, but became a very annoying feature after it was disconnected. Long before 1886 complaints had been frequent of low pressures in some localities and excessive ones in others, and it was hoped that the improvements of the system at that time might do away with the causes of the trouble, but in this there appears to have been a disappointment, for which the old 24-inch discharge main on Watson, Bagg and Butternut streets was largely responsible, as the necessity of a radical departure from the previous lines of distribution was not appreciated, and for some time longer the development of the system was carried forward according to the most correct principles of reservoir distribution, but each year failed to bring the much-hoped-for increases of pressure in the deficient localities.

Topography.

While it is generally known that the surface of the country rises away from the river, few are aware that at the city limits on Woodward avenue the land is fifty-five feet higher than the dock at the foot of that street, and that the Log Cabin Farm is about ten feet higher still. The land slopes from a summit northeast of the intersection of Woodward avenue and the Boulevard downwards in three directions, toward Lake St. Clair, and the Detroit and Rouge Rivers, the slope being most gradual to the southwest. On the maps the contour lines are drawn and their elevations shown above city datum, which is 480.30 feet above mean tide in New York Harbor. This datum was originally assumed 100 feet below the water table of the Pumping Station engine house at the foot of Orleans street.

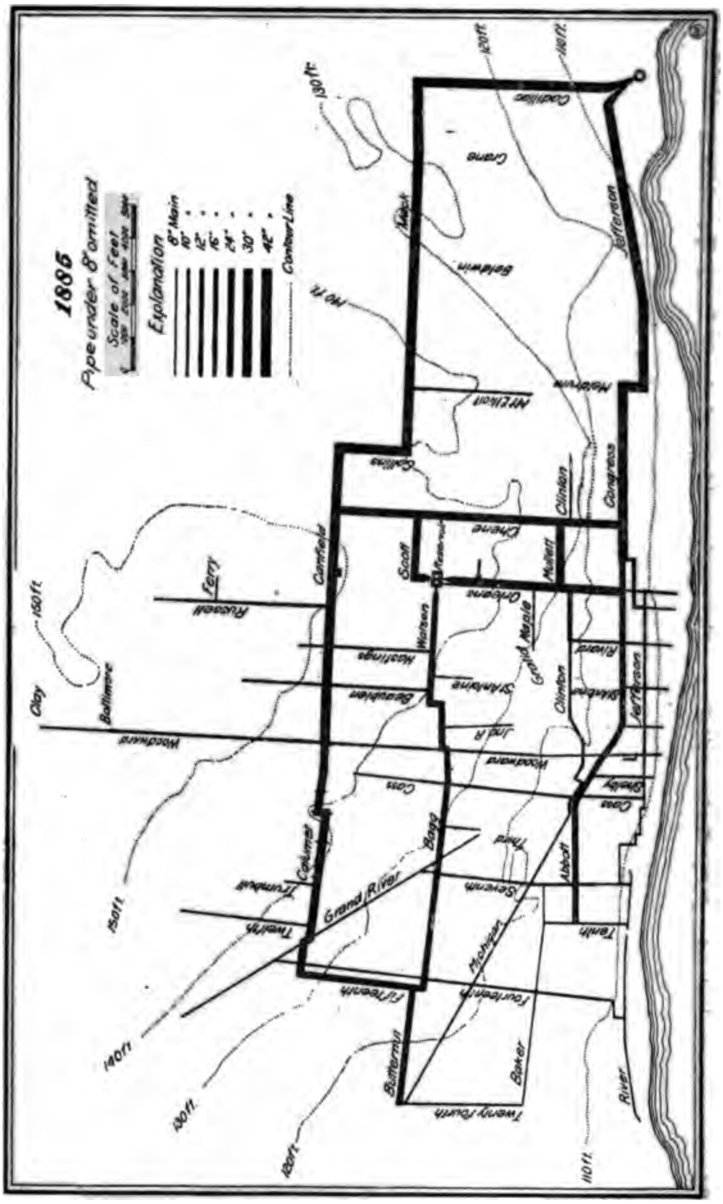
Principles of Distribution.

In the distribution of water, pumping over summits is to be avoided if it is intended to supply consumers on those summits; or, to state the proposition otherwise, the system should be so arranged as to prevent water pumped to the supply of a higher district from flowing away to a lower one. From this it follows that water, once pumped to the level of the old reservoir under the direct system of distribution, should not be allowed to flow to the lower ground south and west. This explains the trouble from the old main, for as long as it continued in open service for its full length, it afforded an easy channel for the escape of the water that should have been retained to supply the high ground, and, as the pressure required to surmount the elevation was considerable, there resulted an excess of pressure in the low western portion of the city. At the time the Canfield avenue main was laid there seems to have been an undeveloped plan to sometime build a new reservoir farther north on more elevated ground, which probably accounts for the line it follows, as when the rearrangement of the system took place, this line was almost as troublesome as the older one. Carrying the above principle to its extremity, a distribution system would consist of what might be represented by a river and its tributary streams, with the current reversed. Each tributary and its branches would then be supplying different levels, and there would be no connection between the sub-systems. Practically, we do not follow the principle to this extent, but only apply it, in a general way, upon the larger mains, relying upon friction in the smaller ones to afford sufficient obstruction to the flow from one district to another.

Past Practice in Operation.

For several years it was customary to divide the system into an upper and a lower service, on which different pressures were maintained at the engines. The original line of division was at the south side of the Canfield avenue main as far west as Vinewood avenue, so that the high portion of the city north of Canfield avenue was fed from the upper service, but by the 24-inch main on Vinewood avenue the low western part of town was also supplied in the same way. The water, of course, flowed to the lower territory as rapidly as it could be consumed, and the frictional losses, combining with the effects of the low level of the points of greatest consumption, reduced the pressures on the high ground far below the desired point.

Plate III.


1886
Pipe under 8" omitted
Scale of Feet
Explanation
8" Main
10"
12"
16"
24"
30"
42"
Contour Line
130 ft.
120 ft.
110 ft.
150 ft.
140 ft.
Cadillac
Crane
Baldwin
Mt. Elliott
Collins
Canfield
Ferry
Russell
Scott
Chene
Mullett
Clinton
Congress
Orleans
Watson
Hastings
Maple
Beaubien
St. Antoine
Rivard
Jefferson
Clay
Baltimore
Woodward
Cass
Shelby
Columbia
Trumbull
Bagg
Third
Abbott
Seventh
Twelfth
Grand River
Michigan
Tenth
Fifteenth
Fourteenth
Butternut
Baker
Twenty Fourth
River
Reservoir

The center of town was supplied along Mullett, Champlain and Congress streets at very little frictional loss, and consequently a considerably lower head could be maintained on the engine supplying that district, but so long as the division of the systems was along Canfield avenue some very high territory near Gratiot avenue was in the lower service and had consequently only a very light pressure. The lower service was practically limited on the west at about Fifteenth street, and had, therefore, a much smaller consumption than the upper, while its supply mains were shorter and of greater capacity, all of which acted against the upper service and the economy of operation.

Readjustments.

The first step taken to ameliorate the troubles was in March, 1893, when, under the instructions of the General Superintendent, your Engineer rearranged the line of division of the systems to coincide with the 130-foot contour and thereby placed the high ground all in the upper service, and throttled the supply in the Vinewood avenue main to reduce the draught from that quarter. As there was then no way of supplying the southwestern territory from the lower service, it could not be entirely cut off from the upper until the construction of the Tenth street and Michigan avenue 24-inch line to afford the desired connection. This was soon begun, but before its completion it was necessary to temporarily supply the western district through the Orleans and Bagg street mains. The Michigan avenue line was completed early in August, 1893, and the upper service permanently relieved of the supply of low territory. The effect was at once apparent in the increase of pressure over the entire high level, ranging from one to six or more pounds. The Bagg street main now being closed at Grand River avenue, the 16-inch main on Park street was extended from its termination at Washington avenue and connected with it at Sixth street, thus providing for a flow from the Mullett street 30-inch into the western part of the Bagg street line and thence northwesterly through the Butternut, Fifteenth and western Buchanan street lines, the Buchanan street 30-inch being closed at Fifteenth street to terminate the upper service at that point. During 1894 a large number of previously existing dead ends in the system were connected to other lines, and many lines which crossed without being connected were joined. A twelve and ten-inch line was laid from the Mullett street 30-inch to the old 24-inch at the corner of Brush street and Edmund place in anticipation of future work in the district above the old line, and a sub-system beginning with a 16-inch main was laid from the Canfield avenue main at Dubois street north and west, to supply the very high territory midway between Canfield avenue and the Boulevard, and late in the season some extensions were made along Fort and Porter streets from Seventh and Tenth streets west, to improve the service in the manufacturing districts along the line of the Michigan Central Railroad. During this year the need of an additional main from the pumping station to Chene street was demonstrated, and its construction comprised the bulk of the work for 1895. This main was only brought into service in March, 1896, and since that time the remaining gaps in the plan of readjustment have been filled by the construction of the 16-inch and its sub-system from the corner of Watson and Brush streets westward and northward, dividing the territory between the old 24-inch and the Canfield avenue main, and the connection of the 42-inch on Canfield with the 30-inch mains on Orleans and Scott streets.

The division of the system into the upper and lower service, on which different pressures were carried at the engines, interfered with the adjustment of the pumping capacity to the demands of consumption, and often necessitated the wasting of considerable quantities of water and also required continued manipulations of the gates at the Pumping Station, as it frequently happened that one engine would be overtaxed, while the other was hardly able to keep moving without wasting water. When, further, it became necessary to run more than two engines, there was difficulty in so arranging matters that the third should work economically, and in 1895 the plan was abandoned, and about the same time the stand pipe was disconnected from the mains.

Results.

The system under which the plant now operates contemplates the discharge of each engine being delivered to all mains at the Pumping Station under the same pressure, which is varied from hour to hour to maintain a constant head at the Water Office, that being taken as the controlling point of the distribution, and to so regulate the quantity of water consumed from each main, by dividing the territory supplied, as to produce by increase or decrease of frictional resistances the proper amount of pressure in each locality. The application of such a method of solving the problem of unequal pressures is limited, for as soon as very great differences of elevation have to be surmounted the extra consumption of fuel for pumping all water against the higher head outweighs the cost of wasting water to work under the divided system, but with our own conditions it seems to be economical. In those places where heavy pressures are carried, the question of equalization would be of no consequence, but in this one it has been the policy to supply only so much as was deemed sufficient for the domestic needs of the localities, fire protection being provided by the aid of steamers. The results obtained by the various changes in the arrangement of the system since the middle of 1891 are shown in the following table:

COMPARISON OF PRESSURES AND HEAD EXPENDED IN OVERCOMING FRICTION, ETC., SINCE THE ESTABLISHMENT OF PRESSURE GAUGES.

PERIOD.	TIME.	Average Pressure at Engines. In Pounds per sq. inch	Average Usable Pressure.		Average Pressure of Elevation.		Average Friction.		CAUSES AND CONDITIONS.
			In lbs. per sq. inch.	In Per Cent of Pres. at Engine	In lbs. per sq. inch.	In Per Cent of Pres. at Engine	In lbs. per sq. inch.	In Per Cent of Pres. at Engine	
July to December, 1891	6 months	No record kept previous to June, 1893.	18.73	....	18.64	....	....	....	System divided on Canfield Ave.—Collins St. and Boulevard mains laying.
January to June, 1892	"		18.29	....	"	....	....	....	
July to December, 1892	"		17.18	....	"	....	....	....	Buchanan St. 16-inch laying.
January to March, 1893	3 months		16.38	....	"	....	....	....	
April to June 20, 1893	2 mos. 20 ds.	43.54	17.28	39.7	"	42.8	7.62	17.5	System divided on 130 feet contour. Very small consumption. Pressure at Engines recorded for June.
June 21 to August 4, 1893	1 mo. 15 days	47.21	18.32	38.8	"	39.5	10.25	21.7	Temporary supply of western district through old 24-inch main.
August 4 to December, 1893	4 mos. 25 ds.	47.63	20.57	43.2	"	39.1	8.42	17.7	Michigan Ave. line in service. Heavy consumption in August and September. Park St. line completed in October.
January to June, 1894	6 months	47.77	21.95	46.0	"	39.0	7.18	15.0	No special construction.
July to December, 1894	"	50.67	23.78	46.9	"	36.8	8.25	16.3	12-in. and 10-in. line in St. Antoine St., etc., also 16-in system north, completed during this time.
January to June, 1895	"	51.58	22.23	43.1	"	36.1	10.71	20.8	Excessive winter consumption. No special construction.
July to December, 1895	"	49.59	22.95	46.3	"	37.6	8.00	16.1	Excessive hot weather consumption. 42-inch main constructing.
January to March 6, 1896	2 mos. 6 days	48.49	23.18	47.8	"	38.4	6.67	13.8	Light consumption. No construction.
March 7 to May 6, 1896	1 mo. 28 days	46.05	23.21	50.4	"	40.5	4.20	9.1	Light consumption. New 42-inch main in service.
May 7 to June 1, 1896	25 days	49.07	24.06	49.0	"	38.0	6.37	13.0	Light consumption. Lower 42-inch main out of service.
June 2 to June 30, 1896	1 month	45.09	23.87	53.0	"	41.3	2.58	5.7	Light consumption. All mains in service.
July to December, 1896	6 months	46.24	23.56	51.0	"	40.3	4.04	8.7	16-in. and 30-in. mains constructing. Light consumption. Canfield Ave. 42-in. shut off in December.

In explanation of this table, it may be said that the pressure at the engines shown in the third column is expended in three ways: First, in surmounting the elevations to which the water is supplied; second, in overcoming the frictional resistances which retard its flow; and lastly, in what may be called the usable pressure, which is that made available for the consumer. The amount consumed from each cause is shown both in actual quantity and in percentage of pressure at the engines. The pressure required in surmounting the elevations, which ranges from only 6¾ pounds at one point to over 27 pounds at another, and averages about 18 2/3 pounds for the entire system, can never be changed so long as the limits of the system do not change, unless the surface of the ground should itself be raised or lowered. It therefore appears that, to increase the usable pressure for the consumer, the pressure at the engines must be increased or the frictional resistances must be decreased. As increase at the engines means increase of cost of pumping, and the frictional resistances increase more rapidly than the amount of water used increases, the importance of reducing them by all available means may be appreciated. How well the operations to this end have succeeded may be seen from a comparison of the period "April to June, 1893," with "June 2 to June 30, 1896," of this table, during which about the same quantities of water were consumed daily. This shows the frictional losses to have been reduced from 7.6 lbs. in the first to 2.6 lbs. in the second, or from 17½ per cent. of the engine pressure to less that 5¾ per cent. Had the system been this year in the same condition as in June, 1893, the cost of fuel for pumping water would have been increased nearly 12 per cent.

The preceding table does not in any way exhibit the results obtained in equalizing pressures, which are set forth in the one following:

YEARLY CHANGES AT VARIOUS LOCATIONS IN MONTHLY AVERAGE USABLE PRESSURE.

LOCATION.	Aug. 1891. Lbs. Pressure.	Aug. 1892. Lbs. Pressure.	AUGUST, 1893.		Aug. 1894. Lbs. Pressure.	Aug. 1895. Lbs. Pressure.	AUGUST, 1896.	
			Lbs. Pressure.	Ch'ge from 1892.			Lbs. Pressure.	Gain from 1892.
Russell and High	13.9	12.7	16.1	+3.4	18.7	19.4	19.8	7.1
Alexandrine and Cass..	15.8	13.3	17.3	+4.0	17.2	16.5	18.0	4.7
Russell and Ferry......	13.1	9.4	11.4	+2.0	13.9	13.6	14.4	5.0
Water Office...........	21.0	21.3	22.2	+0.9	26.7	25.6	27.0	5.7
Hubbard and Fort......	26.4	24.1	23.2	-0.9	26.0	28.0	28.6	2.5

From these two tables it appears that the problem of equalization was practically solved at the end of 1893, and the work of the last three years has been mainly devoted to a general increase of usable pressure and a decrease of frictional losses.

Present Practice in Operation.

In the readjusted system, as completed, beginning with a uniform pressure on all mains at the Works, the upper 42-inch main will supply all territory north and east of a line drawn from the intersection of Greenwood avenue and the Boulevard curving with the convex side southwestward to the intersection of the Canfield avenue main with the new 30-inch main at the alley east of St. Antoine street, thence along the north and east side of the 30-inch to Chene street and southeasterly to the Works. The remainder of the city will be supplied through the middle and lower 42-inch mains on Champlain street and Jefferson avenue. No separation of the territory supplied by the latter is made until Brush street is reached, where, by the closing of a gate in the old 24-inch at Watson street, the flow through the Orleans and Watson street mains is forced into the new 16-inch, and the surplus beyond its capacity goes to re-enforce the new 30-inch at Scott and Orleans streets, the main supply of which comes through the Chene street line, until now practically a dead line, since the systems were first divided. This level extends west to the intersection of Fifteenth and Buchanan streets, and north to the line bounding the upper service. The next level, that crossed by the old 24-inch main from Brush street to Grand River avenue, is fed by the 12 and 10-inch line on St. Antoine, Beaubien and Brush streets from the Mullett street 30-inch, and re-enforced by the lines on John R. street, Woodward avenue and Cass street. The territory south and west of the 130-foot contour will be supplied partly from the Mullett street main through the Park street line and the old lines on Bagg, Butternut, Fifteenth and Buchanan streets, but principally from the lower main extended by the down town piping and the Michigan and Vinewood avenue mains. By reference to the elevations, as shown by the contour lines on the map opposite page 76, it will appear that this arrangement is analogous to the well-designed water piping for a four-story building, in which the supply for the top floor is taken in an independent riser, which corresponds to the upper main, and the other floors are supplied from common risers, but with each floor system separate and so arranged as to be least affected by the consumption on the floors below. It may be incidentally remarked that much of the difficulty experienced in supplying water from our mains to upper floors is due to the neglect, on the part of the designer of the piping in the building, to apply the above principles.

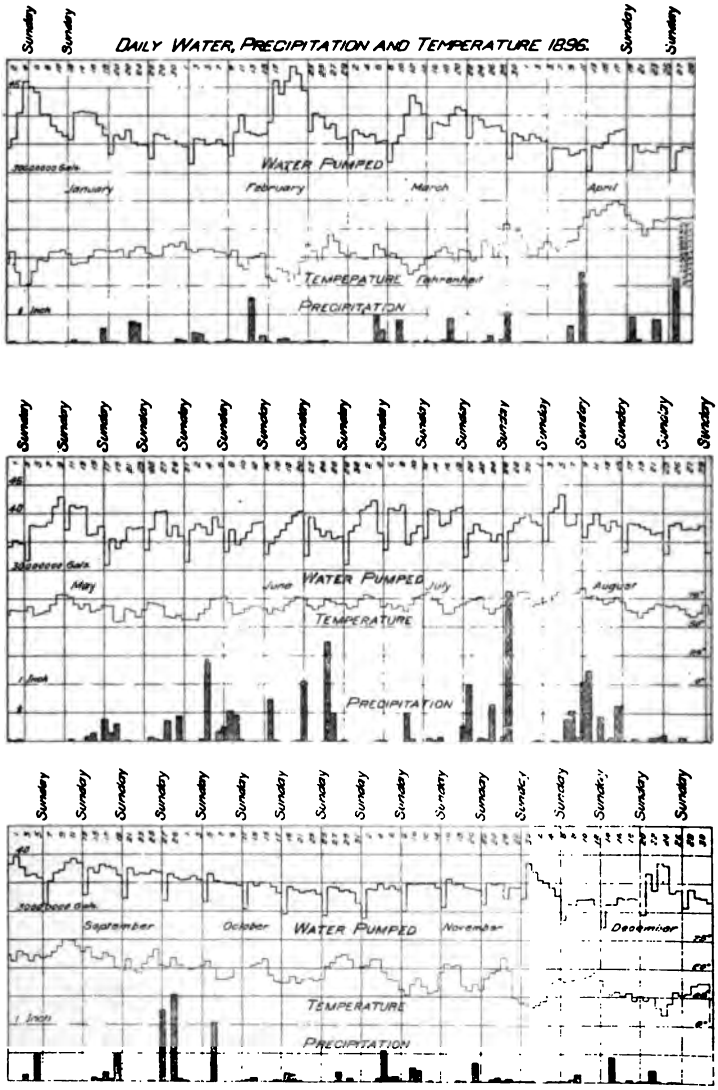
Future Extensions.

As to future extensions, the only one of consequence to be demanded by the growth of the city within its present limits will be from Mack avenue northward, probably upon Cadillac Boulevard. This will ultimately be needed, not only to supply the territory now in the city, but also the territory eastward along Gratiot avenue. The most immediate problem is likely to be the supplying of the village of Delray and the adjoining territory. For this a main carried westward from the Vinewood avenue line, probably on or near Fort street, seems now to be the most promising solution. Growth in the district along and north of Michigan avenue, in Springwells, may be provided for from the 16-inch main in Buchanan street, now extending to Livernois avenue. As the territory along Grand River avenue beyond the present city limits is built up, it will probably become necessary to lay a main along Grand River avenue to connect the 30-inch on Buchanan street to the 24-inch in the North Boulevard, from which a branch may be carried to supply the demands on Warren avenue. The 30-inch main on Collins street, extending to Griffin street, appears to furnish sufficient capacity for the extensions that may be needed along the line of the D., G. H. & M. Railway, and when the consumption toward Grosse Pointe outgrows the capacity of the present lines in that direction, a larger main can be taken from the Pumping Station directly to the point desired. The necessary sizes of these several lines it would be useless to attempt to establish, as when they are needed much more accurate information can be obtained as to the requirements than is available now. It is to be borne in mind, however, that, while the probable future extensions will be unlikely to cause serious difficulty, the one just made may compel, at some future day, the establishment of a high service pumping station somewhere in the northern part of the city to supply the very high levels north of the Boulevard, for, with the present small consumption there, our engines are barely able to overcome the friction and elevation, and deliver water with a fair margin of usable pressure at the city limits, and as the consumption increases the friction will increase rapidly. It may be possible to apply to this territory Mr. McAlpine's recommendation of balancing reservoirs and thereby avoid the expense of maintaining the auxiliary pumping station, but these are problems of the future and it seems hardly likely that they will demand attention before 1900.

Consumption in 1896.

Several conditions have combined during the past year to make it almost as notable in its water consumption as the one preceding it, but in the opposite way. The average daily, per consumer, consumption has been about 131 gallons, or very nearly the same as in 1882. Not only during the summer, but also during the winter, the temperature favored low consumption, and the efforts made to persuade our citizens to curtail the extravagant use of water for sprinkling, combined with the damp season and the reduced pressures at the engines, have all added their effects in producing the reduction. To those who are interested in this matter, a comparison of Plate VII, page 66, of the Report for 1895, with Plate IV, page 70, will be highly instructive.

Plate IV.



DAILY WATER, PRECIPITATION AND TEMPERATURE 1896.

Experiments on Lawn Sprinkling Apparatus.

Early in the season, at the request of your General Superintendent, a series of experiments were carried on, under the direction of the writer, to determine the quantity of water that would be used by the various lawn sprinkling devices and garden hose nozzles on the market. Twenty-nine sprinklers and eight nozzles were tested under various conditions, the results being presented in the table on pages 72-3. Briefly, it may be said that the quantity of water consumed by the different appliances tested varied from four to thirteen barrels per hour, and the depth to which the water would cover the area sprinkled in one hour, if all were confined upon its surface, ranged from 0.2 inch to 5 inches.

An ordinary rainstorm seldom amounts to more than three-quarters of an inch in six or eight hours, from which fact may be inferred the wastefulness of drenching a portion of a lawn in a few minutes with from one-half to one inch of water, as many of the sprinklers do.

These experiments proved that, with our low pressures, those sprinklers which depend for the distribution of the jet on a rotation of the water itself in a chamber without moving parts are not satisfactory, although some probably would be so at higher pressures, and those in which the spray was thrown by light revolving vanes gave the best results, some of them exceeding in area sprinkled the various rotating arm sprinklers tested.

NAME OR KIND OF APPARATUS	Pressure At Main.	Length of Connection.	Length of Hose.	Hight of Jet.	Horizontal Length of Jet.	Gallons per Minute.	Barrels per Hour.	Mean Diam. of Wet Area.	Extra length to outside drops from Centre.	Area of Wet Surface. Sq. Ft.	Depth of water on Wet Area per Hour.
											Inches.
Plain Straight	31.5	100 ft.	25' 4"	6' 4"	38' 0"	5,625	......	......	......	......	......
Plain, Tip removed	"	"	"	......	......	7,387	......	......	......	......	......
Plain, Crown spray	"	"	"	......	......	6,713	......	......	......	......	......
Plain Nozzle, with cock	33 5	"	"	6' 0"	33' 0"	6,205	......	......	......	...	......
Plain, with Amazon spray	"	"	"	......	......	6,550	....	......	......	......	......
Numyr Nozzle	"	"	"	7' 3"	40' 0"	2,985	5,671	......	......	......	......
Numyr, with spray	"	"	"	......	......	2,273	4,319	...	......	523.60	0.42
Peerless Nozzle	"	"	"	7' 3"	40' 0"	3,653	6,943	......	......	......	......
Peerless, with fine spray	"	"	"	......	......	1,922	3,652	......	......	125.36	1.48
Peerless, with heavy spray	"	"	"	......	......	3,837	7,290	......	......	306 40	1.21
Magic Nozzle	"	"	"	9' 0"	40' 0"	4,276	7,924	...	......	......	......
Magic, with spray	"	"	"	......	......	2,663	5,060	...	......	176.71	1.45
Crown Nozzle	"	"	"	6' 0"	35' 0"	3,381	6,424	...	......	...	....
Crown, with spray	"	"	"	......	......	5,465	10,384	......	......	108.00	4.93
Boss Nozzle	"	"	"	6' 0"	33' 0"	5,109	9,707	......	......	......	......
Boss, with spray	"	"	"	......	......	6,597	12,514	......	......	350 00	1.82
Gem Nozzle	"	"	"	9' 0"	41' 0"	5,086	9,663	......	......	......	......
Gem, with fine spray	"	"	"	......	......	2,244	4,264	......	......	165.00	1.31
Jewell Nozzle	"	"	"	7' 3"	36' 6"	3,100	5,890	......	......	......	......
Jewell, with spray	"	"	"	......	......	2,487	4,712	......		173.19	1.38
Wolverine (Peerless)	"	"	75' 7"	......	......	6,739	12,806	32' 0"	1' 0"	804.25	.81
Noera	"	"	"	......	......	5,909	11,227	29' 0"	0' 6"	660.52	.86
Waterbury	32.5	"	"	......	......	5,535	10,516	27' 0"	2' 6"	572.56	.93
Blairs' California	33.0	"	"	......	......	5,135	9,757	37' 0"	2' 6"	1,075.21	.46

Cleveland	33.0	100 ft.	75' 7"	.....	.....	6,882	13,076	30' 0"	1' 0"	706.86	.94
Crescent Giant	"	"	"	.....	.....	6,395	12,150	28' 0"	1' 0"	615 75	1.00
Cactus, No. 4	"	"	"	.....	.....	5,932	11,271	32' 0"	0' 6"	804 25	.71
Cactus, No. 9	"	"	"	.....	.....	6,122	11,632	31' 0"	1' 0"	754.77	.78
World	"	"	"	.....	.....	6,332	12,031	24' 0"	2' 0"	452.39	1 35
Eclipse	31.5	"	"	.....	.....	4,765	9,055	32' 0"	4' 0"	804.25	.57
Detroit, No. 2, set fine	"	"	"	.....	.....	7,341	13,948	27' 0"	0' 6"	572 56	1.23
Flirter	"	"	"	.....	.....	5,782	10,986	26' 0"	1' 0"	530.93	1.04
Baby Marion	"	"	"	.....	.....	2,854	5,423	20' 0"	2' 0"	314 16	.87
Kelpie	"	"	"	.....	.....	3,463	6,580	32' 0"	2' 0"	804.25	.42
Little Wonder	"	"	"	.....	.....	2,835	5,387	28' 0"	1' 0"	615.75	.44
O. K., large, open	31.0	"	"	.....	.....	4,103	7,795	30' 0"	1' 0"	706.86	.56
O. K., small, open	"	"	"	.....	.....	3,979	7,562	30' 0"	2' 0"	706.86	.54
Bonnette's Arc	"	"	"	.....	.....	3,142	5,970	36' 0"	2' 0"	1,017 88	.29
Crescent Arc, full circle	"	"	"	.....	.....	3,860	7,334	28' 0"	5' 0"	615 75	.60
Crescent Crown	"	"	"	.....	.....	4,766	9,055	37' 0"	1' 0"	1,075.21	.42
Frontier	"	"	"	.....	.....	2,068	3,929	36' 0"	2' 0"	1,017.88	.19
Active	"	"	"	.....	.....	5,168	9,819	31' 0"	4' 0"	754.77	.65
Jewel	"	"	"	.....	.....	5,401	10,260	30' 0"	2' 0"	706.86	.73
Perfection	"	"	"	.....	.....	4,252	8,079	36' 0"	6' 0"	1,017.88	.40
Waterwitch	"	"	"	.....	.....	3,934	7,575	40' 0"	4' 0"	1,256.63	.30
Ball Nozzle Sprinkler	32.5	"	"	.....	.....	5,236	9,948	29' 0"	0' 6"	660.52	.76
Park	"	"	"	.....	.....	4,772	9,069	32' 0"	1' 0"	804.25	.58
Success	"	"	"	.....	.....	4,877	9,266	26' 0"	1' 0"	530 93	.88
Japanese, finest spray	"	"	"	.....	.....	5,015	9,528	33' 0"	1' 6"	855.30	.58
Bonnette's Arc, half circle	"	"	"	.....	.....	3,227	6,131	40' 0"	5' 0"	628.31	.49
Crescent Arc, half circle	"	"	"	.....	.....	2,299	4,370	31' 0"	4' 0"	377.38	.59
Jewel Arc, half circle	"	"	"	.....	.....	3,580	6,802	32' 0"	2' 0"	402.12	.86
O. K. Arc, 255°	"	"	"	.....	.....	3,538	6,722	33' 0"	3' 0"	650.21	.52

CHART OF DEACON METER INVESTIGATIONS.

DATE.		TERRITORY.		LOCATION.	PIPE.				HOURLY CONSUMPTION. U. S. GALLONS.	
Day.	Hour.	District.	Section		Length.	Size.	When Laid.	Taps.	By Sec. and Dist.	Per Tap.
1896. 11-10	A. M. 12:10-12:19	No. 6.	I	Brush St., Adelaide to Division.	234 feet. 20 " 36 "	10 in 8 " 6 "	1894	8	839	104.9
	12:19-12:41		II	Adelaide St., Brush to Beaubien	378 "	10 "	1894	7	480	68.3
	12:41- 1:04		III	Adelaide St., Woodward to Brush John R St., Adelaide to Winder	1260 " 394 "	8 " 8 "	1894 1868	46	480	10.4
	1:04- 1:33		IV	Winder St., Woodward to John R	716 "	4 "	1853?	28	240	8.6
	1:33- 1:53		V	John R St., Winder to High High St., Woodward to John R	481 " 57 " 780 " 100 "	4 " 4 " 8 " 4 "	1868 1854 1894 1854	44	1439	32.6
	1:53- 2:30		VI	Winder St., John R to Brush Brush St., Adelaide to High	632 " 761 "	4 " 4 "	1854 1854 1872 1888	32	240	7.6
	2:30- 2:49		VII	Winder St., Brush to Beaubien	310 "	4 "	1854	12	60	5.0
	2:49- 3:14		VIII	Napoleon St., Brush to Beaubien	310 "	4 "	1888	14	539	38.6
	3:14- 3:25		IX	High St., John R to Beaubien	934 "	4 "	1854	35	719	20.6
	3:25- 3:44		X	Beaubien St., Adelaide to High	160 " 841 "	6 " 10 "	1894	29	360	12.4
	3:44- 4:16		XI	Beaubien St., High to Columbia	60 " 490 " 20 " 60 "	12 " 10 " 8 " 6 "	1894	12	240	20.0
	4:16- 4:40		XII	Beaubien St., etc., 12 inch, Columbia to Adams	1022 " 8 "	12 " 6 "	1894	38	360	10.9
	4:40- 4:58		XIII	Beacon, e. of St. Antoine St. Antoine St., Adams to Gratiot	211 " 626 " 70 " 20 "	4 " 12 " 6 " 4 "	1886 1894	29	600	20.6
	4:58- 5:22		XIV	Catherine and Hastings Sts., 12 inch	890 " 70 "	12 " 4 "	1894 1854	42	900	21.2
				Totals and Means of District	11951 feet.	......	......	376	7496	19.9

1896. 11-25	12:00 A. M.	No. 1 A.	1	Adams Ave., St. Antoine to Hastings..	598 feet.	4 in.	1866	36	240	6.7
	12:00-12:22		II	Elizabeth St., Beaubien to Brush	339 "	4 "	1854	17	360	21.2
	12:22-12:52		III	Witherell St., Madison to Adams	244 "	4 "	1870	9	959	106.9
				Madison Ave. n., Witherell to John R	396 "	4 "	1854			
				John R St., Madison to Alley s. of Cross St.	105 "	4 "	1854			
	12.52- 1:08		IV	Adams Ave., Brush to Witherell	881 "	4 "	1854	35	480	13.8
	1:08- 1:22		V	Adams Ave., 6 inch, Randolph to John R	241 "	6 "	1868	5	420	83.9
	1:22- 1:41		VI	John R. St., Adams to Alley s. of Cross	204 "	4 "	1854	17	120	7.1
				Alleys n. and s. of Cross St., John R to Randolph	371 "	4 "	1854			
	1:41- 2:04		VII	Miami Ave., Witherell to John R	394 "	4 "	1854	17	420	24.7
				John R St., Miami to Centre	165 "	4 "	1856			
	2:04- 2:20		VIII	Madison Ave. s., Witherell to John R John R. St., Centre to Madison	448 "	4 "	1856	27	659	24.5
				Alley n. of Centre, John R. to Randolph	435 "	4 "	1869			
	2:20- 2:42		IX	Alley e. of Miami Ave., John R to Randolph	761 "	4 "	1856	48	1319	27.2
				Randolph St., Gratiot to Madison	704 " 18 "	6 " 4 "	1869			
	2:42- 3:21		X	Madison Ave., Brush to Randolph	241 "	6 "	1894	27	180	6.6
				Randolph St., Madison to Adams	513 " 16 "	6 " 4 "	1869			
	3:21- 3:51		XI	Brush St., Gratiot to Madison	409 "	3? "	1854	31	180	5.7
	3:51- 4:08		XII	Mechanic St., Brush to Beaubien	330 "	4 "	1878	9	360	39.9
	4:08- 4:27		XIII	Brush St.. Madison to Adams.	581 " 48 " 30 "	8 " 6 " 4 "	1894	27	180	6.6
	4:27- 4:59		XIV	Beaubien St.. Madison to Elizabeth.	1054 "	4 "	1854	31	719	23.1
				Beacon St., Beaubien to Brush	330 "	4 "	?1878			
	4:59- 5:19		XV	Beaubien St.. Gratiot to Madison	319 "	8 "	1894	46	719	15.6
				Madison Ave., St. Antoine to Brush	334 " 474 "	8 " 4 "	1877			
	5:19- 5:45		XVI	Beacon St., St. Antoine to Beaubien	469 "	4 "	?1871	25	240	9.6
	5:45- 6:00		XVII	Adams Ave.. St. Antoine to Brush	870 "	4 "	1854	38	240	6.4
	6:00- 6:15		XVIII	Beacon e. of St Antoine	211 "	4 "	1886	29	719	24.8
				St. Antoine St., Gratiot to Adams	626 " 70 " 20 "	12 " 6 " 4 "	1894			
	6:15- 6:25		XIX	Hastings St., Mullett to Catherine.	890 "	12 "	1894	42	719	17.1
				Catherine St.. Hastings to St. Antoine	70 "	4 "	1854			
				Totals and Means of District	14209 feet.	......	......	516	9233	17.9
				Net Totals and Means of Two Districts	24273 feet.	......	....	821	15209	18.5
				Daily Average Apparent Waste, per tap, about	....	... ..	...	....	......	81.1

Waste Detection.

In pursuance of the recommendations in the Annual Report for 1895, a six-inch Deacon waste detection meter was purchased and set at the intersection of Hastings and Mullett streets on a by pass around a gate in the 12-inch main leading north. From this location it was possible to examine territory extending from Woodward avenue to Riopelle street, and from Mullett street to Adelaide street. Of these investigations, the results from two districts covering a considerable range in the character of the inhabitants have been selected, and are presented in the table on pages 74-5. This table shows the water passing hourly through 821 connections, supplying about 4,500 people, during the time between 12 o'clock midnight and 6 o'clock A. M., and which may be assumed to be practically all wasted. The table shows many interesting things, but only a few will be considered here. It forcibly brings out the fact that the waste is by no means universal; that the majority of the consumers keep their fixtures in good condition, and that it is only occasionally that we find the ones responsible for the leaks. It also shows that oftentimes those who pay the highest water rates waste the least water. For example, on Winder street, from Woodward avenue to John R. street, 28 connections, with 716 feet of 4-inch pipe laid previous to 1854, show a waste of about 9 U. S. gallons per tap hourly, which is no more than some lawn sprinklers throw in one minute, while on Napoleon street, from Brush street to Beaubien street, 14 connections, with 310 feet of 4-inch pipe laid in 1888, show a loss of over 40 gallons hourly per tap. The average waste in the districts included in the table appears to be about 80 gallons per consumer daily, which corroborates the previous estimates of average useless consumption. The many duties devolving upon this department in connection with the

construction of the past season have prevented the carrying of the waste detection investigations to completion, and the work done in this line is to be regarded as largely preliminary, as considerable time was consumed in becoming familiar with the working of the apparatus and the methods of operating in the various districts. That the Deacon meter will prove a valuable aid in locating the places where the greater losses occur has been established beyond question.

With reference to the routine work of the Engineering Department, comment is unnecessary. The records speak not only for themselves, but for all who have been connected with their preparation and preservation.

The thanks of your Engineer are extended to all those, not only in our own and other city departments, but many unofficially connected with public service, who have afforded us courtesies and information, and particularly to your honorable body and the General Superintendent, for the kind consideration and high appreciation which have been evinced toward the work of my subordinates and myself.

All of which is, gentlemen, very respectfully submitted.

GARDNER S. WILLIAMS,
Civil Engineer.

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

Detroit, January 2d, 1897.

To the Board of Water Commissioners:

Gentlemen—In compliance with the rules and regulations of your honorable body, I herewith report the work done in the Meter, Inspection, Service Cocks and Repairing Leaks Department during the year 1896:

The following table shows the number of meters placed during the year and total number in service on the 31st day of December, 1896:

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
In service January 1, 1896.	1,911	786	653	149	167	69	36	4	3,775
Placed during the year 1896	561	136	68	24	9	3	6	2	809
Total number in service January 1, 1897.........	2,472	922	721	173	176	72	42	6	4,584

The following table shows the total number of meters in service, the different kinds and sizes, and also the number of indicators attached to hydraulic elevators:

IN SERVICE JANUARY 1, 1897.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson..	2,418	900	625	159	140	54	27	6	4,329
Crown.	34	14	45	10	12	9	4	....	128
Hersey	1	4	34	2	11	2	7	...	61
Worthington..	10	4	16	...	12	7	3	....	52
Union Rotary......... ...	8	....	1	2	1	....	1	....	13
Buffalo	1	....	....	....	....	....	...	....	1
Aggregate............ .	2,472	922	721	173	176	72	42	6	4,584

Indicators attached to hydraulic elevators, 13.

METERS IN STOCK.

KIND.	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Thomson (new)	......	23	8	2	4	1	1	39
Crown	2	1	1	2	1	.....	.....	7
Hersey	1	......	11	1	2	......	1	16
Worthington	2	......	1	......	......	......	......	3
Union Rotary	1	......	6	......	1	......	......	8
Neptune	26	......	1	......	1	......	......	28
Trident	25	......	......	......	......	......	......	25
Aggregate	57	24	28	5	9	1	2	126

Valuation of meters in stock January 1st, 1897	$ 1,631 00
Valuation of material on hand January 1st, 1897	472 82
Valuation of tools January 1st, 1897	486 57
Valuation of horses, wagons, etc., January 1st, 1897	380 00
Valuation of furniture and fixtures	100 00
	$ 3,070 39
Valuation of meters in service January 1st, 1896	$ 91,571 58
Deduct 10 per cent. for depreciation in value	9,157 15
	$ 82,414 43
Add amt. expended during the year for meters placed	18,140 61
	$100,555 04
Less stock on hand January 1st, 1897	3,070 39
Total valuation of meters in service January 1st, 1897	$ 97,484 65
Cost of material used in repairing meters, 1896	$ 273 19
Cost of labor, repairing meters, 1896	1,048 77
	$ 1,321 96
Less amt. received for repairing meters, 1896	24 50
Total cost of repairs, 1896	$ 1,297 46

SUMMARY OF TOTAL AMOUNT EXPENDED IN THE METER DEPARTMENT, FOR THE YEARS 1889 TO 1896, INCLUSIVE.

	1889	1890	1891	1892	1893	1894	1895	1896	TOTAL.
Meters............	$11,175 00	$18,700 00	$6,501 55	$12,371 82	$6,987 43	$8,824 08	$9,235 11	$10,435 76	$84,230 75
Supt. and labor.....	1,734 10	8,510 57	4,841 49	8,269 17	8,980 48	6,672 20	6,647 89	6,340 08	51,995 98
Material, tools, etc...	637 26	2,982 14	872 99	2,132 93	1,650 33	1,833 01	1,384 85	1,035 15	12,528 66
Freight, hauling, etc.	98 05	408 97	197 11	244 08	165 12	201 18	71 40	91 11	1,477 02
Horses, wagons, etc..	....	....	....	547 24	184 50	383 07	248 60	238 51	1,601 92
TOTALS.......	$13,644 41	$30,601 68	$12,413 14	$23,565 24	$17,967 86	$17,913 54	$17,587 85	$18,140 61	$151,834 33

Eight hundred and nine meters were placed during the past year, making the total number now in use forty-five hundred and eighty-four (4,584). Of the 809 meters, 795 were placed at the request of consumer.

The longer the meter system is in use, the more popular it becomes with water consumers, as they now understand that it only requires good plumbing and reasonable care in order to get an abundant supply of water at a very small cost. If any additional facts were necessary to prove its justness, the past year has produced many of them.

If it is fair for each consumer to pay for quantity used, then the only way for him to get justice is to pay by meter measurement. If there is to be a price for water, there is no other way to deal fairly with all. An estimated assessment is based on the quantity consumed, and as it is utterly impossible to estimate correctly, it does not seem as though there could be any reasonable objection to the meter, which records the exact quantity consumed.

A case in point during the last three months is quite interesting: The owner of a house on Park street was notified to repair leak in water pipe leading to a closet, and he objected, claiming it was small and he did not want to be put to the expense of repairing it, and requested a meter placed on the premises, saying "he would pay for all waste rather than go to the trouble and expense of stopping it." On October 3rd we placed the meter, and the first month's consumption was 88,500 gallons, the second month 96,750 gallons, third month 114,750 gallons, making the consumption, from October 3rd to December 28th (85 days), 300,000 gallons. The family occupying the house consists of three persons, which makes an average daily per capita consumption of 1,166 gallons. The estimated rate on the premises was $11 per year, and the present meter rate (unless leak is repaired) will be about $35. Just how long the owner will continue to pay the present rate rather than repair leak is a question for himself to decide, but when it is considered that other houses in the same block, containing more water fixtures than his, are using less than 7,000 gallons per month, making their yearly payment $6, it would seem as though it was of enough importance to have it repaired.

Another case where one of our leak examiners found water running in closet on different occasions, and not being able to convince the owner that such waste was not necessary, suggested it as a proper place to set a meter, and we did so, producing the following results: The first fifteen days showed a consumption of 45,000 gallons. The estimated assessment for that time had been paid at the yearly rate of $5, the assessor not knowing that there was a closet on the premises, which seems to have been there several years without being discovered. The first month's meter bill (which was for July last) showed 15,000 gallons, for which they paid; and since that time (five months) their average monthly consumption has been 2,660 gallons, making their daily per capita consumption 18 gallons instead of 600 gallons, as they were using when the meter was first placed. The owner has been convinced of two things—first, that it is not necessary to keep a running stream in closet, and second, it pays to be careful in the use of water as well as it does any other commodity.

The meter, in addition to its being a great leak detector, etc., has a moral feature that should not be overlooked. If all consumers were metered, water could be furnished in this city at such small cost that every person could have a bountiful supply, and nobody need resort to any misrepresentations, such as concealing families, fixtures, etc., something that would certainly relieve the conscience of an occasional water consumer.

We have been deducting 10 per cent. each year from the valuation of meters in service, to cover the loss by wear and tear, but I am satisfied that 5 per cent. will fully provide for all losses from that source, as during the past year we have had occasion to test several meters that have been in service for seven years and over, and find them in almost perfect order. In some cases a portion of the gear has to be replaced; otherwise the machine is, apparently, as good as new, proving that at the end of ten years a large proportion of the meters that have been in use that length of time will be good for at least as many more years, and probably much longer, only requiring reasonable care and a slight amount of repairs.

Inspection.

During the past year the leak examiners made 49,630 examinations, and reported 2,623 leaks, 2,312 of which were repaired within the specified time given for same, and 311 were ordered shut off for failure to make the necessary repairs.

The percentage of leaks to number of examinations made has fallen off from 8.02 per cent. in 1895 to 5.28 per cent in 1896, showing that the system of regularly examining the service connections throughout the city is producing good results.

In addition to the foregoing, the examiners also delivered 46,700 of the "New Regulations for Use of Hose and Sprinklers," having delivered one at every occupied building in the city. As the past season was not one that required a very large use of hose, we were not able to judge very accurately what effect they will have, but, judging from the number of enquiries from consumers in regard to them, we think that it will be a very beneficial one. Still, there are some who think it arbitrary on the part of the Water Board not to allow them to set out their sprinkler on the first warm day in spring and not take it in again until the snow flies in the fall, and allow it to operate continually.

The examiners also spend about twelve days each month reading meters and delivering meter bills, which makes it impossible to get over the city twice each year in their leak examinations: still, as the number of metered services increase, in the same proportion do the service connections that need inspecting decrease, as after a meter is set, no further examinations for leaks are necessary, as the owner or occupant then becomes an interested party.

Service Connections.

Seventeen hundred and seventy-seven (1,777) service connections were made during the past year; 725 of them were ⅝-inch, 1,002 1-inch, 40 2-inch, 4 3-inch, 3 4-inch and 3 6-inch. Eighty-four five-eighths and 12 1-inch service connections were discontinued, making the total number of service connections in the city on the first day of January, 1897, 50,599.

In addition to that, there were inserted for the iron pipe department, in streets where the old mains had been removed and replaced with larger ones, 551 five-eighths and 355 1-inch service cocks, which were connected up with the old service pipes on the different premises. The Water Works furnished the screw service cock, and retained all of the old drive cocks that were taken out, all of which were sold, by order of the General Superintendent, and the amount received therefor credited up to the Service Cocks Department.

There were 350 more service connections made in 1896 than there were in 1895, accounted for, partially, by the Water Works having made the connections on vacant property on streets that were about to be paved; 460 of such were made, the service pipe extending from main to one foot inside of curb line, where a stop-box was placed. Hereafter, if all service connections are made on streets before they are paved, it will save much annoyance and expense, and also add largely to the lasting qualities of the pavement, as it will stop the necessity of disturbing it in any way for making such connections thereafter.

The following statement will show the receipts and disbursements in the Service Cocks Department during the past year:

Receipts for service cocks			$5,229 75
Receipts for plumber licenses			565 00
Receipts for labor and material			160 20
			$5,954 95
Total expense of Service Cocks Department		$11,284 95	
Less labor of inspectors	$5,120 00		
Less two buggies and eight buggy tops.	224 50		
		5,344 50	
			5,940 45
Balance to credit for Service Cocks			$ 14 50

Inspection of New Work.

The inspectors in this department have a gradual increase in the amount of work in their different districts each year. Still they are able to give close attention to all new work, and such additional work as they are called upon to do for the Assessors, and at the same time are gradually getting their record books, containing the location of all stop-boxes on service connections, in good shape. When they are completed, they will be of much benefit to the Works. With proper attention given to the recording of all new boxes there ought not to be any difficulty in locating stop-boxes in the future.

There have been no changes in this department during the past year, everything having been conducted as in former years.

The following table will show what the inspectors have done during the past year, in addition to their work on record books:

INSPECTION OF NEW WORK.

INSPECTORS.	DISTRICTS.	Examined New Connections.	Examined Extensions and Fixtures.	Let on New Connections.	Notified for Building Tax.	Call for Non-Payment.	Shut for Non-Payment.	Let on, Vacancy and Re-occupied.	Shut for Vacancy and Request.	Examined for Assessors.	Delivered Meter Bills.	Totals.
John Hatzenbuhler	1	348	226	203	104	1,466	88	171	228	346	766	3,946
Robert Pelham, Jr.	2	132	390	160	112	2,285	123	219	289	976	1,192	5,878
C. K. Skinner	3	179	874	86	55	3,135	121	408	482	848	1,214	7,402
William Forsyth	4	154	463	79	30	2,841	127	319	359	647	1,949	6,968
Frank Clark	5	231	539	71	49	3,965	109	420	793	771	1,974	8,922
Michael Hart	6	130	565	118	66	1,902	199	354	364	458	1,447	5,603
John Becker	7	325	379	89	83	1,897	100	466	496	1,165	903	5,903
Adolph Jasnowski	8	278	448	191	21	1,608	107	334	285	2,176	1,212	6,660
Total	...	1,777	3,884	997	520	19,099	974	2,691	3,296	7,387	10,657	51,282

Plumbers and Plumbing.

One hundred and thirteen (113) licenses were issued to plumbers during the last year, being 12 less than in 1895.

Having to pass an examination before the Board of Plumbing Examiners, and produce a certificate from the Board of Health as to their competency, before a license is granted them, has undoubtedly driven some who called themselves plumbers out of business. There seems to be plenty left, however, to do all the business in their line. The competition has been so great for some time past, and prices cut to such an extent, that the tendency is to slight work, and it requires the strictest attention on the part of our inspectors to see that all material and work is done in accordance with the rules and regulations of the Board. I believe, however, that the average plumbing work being done throughout the city at the present time, from both material and a sanitary point of view, is much better than at any time in the previous history of our Works, due largely to the efforts of our inspectors, in connection with those of the Board of Health.

TABLE SHOWING THE NUMBER OF TAPS MADE, AND THE DIFFERENT SIZES, IN EACH WARD DURING THE YEAR 1896; ALSO THOSE DISCONNECTED.

NEW CONNECTIONS.	SIZES.	WARDS.																Total inserted.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Iron Pipe.........	⅝ inch	21	5	27	4	13	33	19	50	33	40	27	42	62	49	152	148	725
" "	1-inch	116	164	92	253	19	24	13	25	17	16	15	19	25	20	135	49	1002
" "	2-inch	4	2	....	1	1	3	2	4	1	3	1	5	2	2	8	1	40
" "	3-inch	1	1	1	....	....	....	....	....	....	....	....	....	....		....	1	4
" "	4-inch	1	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	3
" "	6-inch	2	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	3
" "	8-inch	....	....	....	....	....	....	....	....	....	....	....	....				....	....
" "	10-inch	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....		....
Aggregate..............		145	172	120	258	34	60	34	79	53	59	43	66	89	71	295	190	1,777
DISCONTINUED CONNECTIONS.																		Total discontinued.
Iron Pipe	⅝ inch	3	34	13	7	4	3	1	5	5	4	..	3	.....	1	.....	1	84
" "	1 inch	..	6	1	..	....	....	....	.	1	....	....	....	....	....	1	3	12
Aggregate.........	....	3	40	14	7	4	3	1	5	6	4	....	3	..	1	1	4	96

TABLE SHOWING THE NUMBER OF SERVICE CONNECTIONS IN USE JANUARY 1, 1897.

SIZE OF CONNECTION.	Number in use Jan'y 1. 1896.	Added in 1896.	Discontinued in 1896.	Total in use Jan'y 1. 1897.
⅝ inch	36,997	725	84	37.638
1 "	11,480	1,002	12	12,470
2 "	181	40	......	221
3 "	134	4	......	138
4 "	114	3	......	117
6 "	9	3	.....	12
8 "	2	.....	......	2
10 "	1	.....	.....	1
	48,918	1,777	96	50,599

Repairing Leaks.

The watchfulness and care necessary on the part of the Leak and Repair Department are understood and appreciated by only a few people. When even one of the smallest mains breaks, there is always more or less damage, and a break in one of the larger mains involves danger as well as damage.

Since the last report there have been four comparatively serious breaks in mains.

On April 2nd, opposite the Majestic Building on Woodward avenue, a wood plug in a 6-inch "T," which had been in use since 1872, by the action of water and sand became loose, and the flow of water caused a washout into the sewer, making a hole under the asphalt pavement about the size of a street car. Fortunately, it was discovered before injury came to any person.

Practically a similar incident occurred at Riopelle and the alley north of Mullett street, on August 19th. A 6-inch pipe had been broken square off by the settling of a sewer-ditch, and the water found its way out through the sewer. It had, however, washed out a hole under the pavement about 10 feet deep, 15 feet long and 12 feet wide, leaving the pavement in its place. A man with a milk wagon attempted to drive over it, but failed. His horse got across safely, but the man, wagon and milk cans landed at the bottom of the hole. The man was not injured; neither was the wagon.

The settling of made ground in the alley east of the Union Trust Building broke the 4-inch service pipe that leads to said building, on November 23rd. The basement was in fifteen or twenty minutes flooded so as to put out the fires under the boilers.

At Vinewood avenue and the Michigan Central Railroad, a split in the 24-inch main was luckily discovered in time to prevent any considerable washout, but the trouble was serious enough to cause the railroad company to abandon the tracks nearest the break until it was repaired. While there is no positive evidence to bear out the statement, yet the probability is that the heavy and rapid moving trains at that point caused the break. The pipe, however, showed a weakness due to a strain, probably caused in cooling.

The repairing of leaks in a plant the size of the Detroit Water Works is no small item. As the plant is extended, the possibilities for leaks increase, although the number of leaks, as compared to the miles of pipe and number of service connections, are decreasing, owing to improved methods in construction, such as testing main pipes to a pressure of about 80 pounds before they are put in service, inserting service cocks with a screw instead of driving them in after drilling a hole; also requiring plumbers to use lead pipe known as "strong," instead of "medium," as was formerly allowed.

Of the number of leaks in mains, 2 were in joints of 42-inch, 4 in 24-inch, 1 in 16-inch, 2 in 8-inch, 6 in 6-inch, 5 in 4-inch and 3 in 3-inch. Six breaks, and two plugs becoming loose in 4-inch branches caused leaks, and one wood plug in 8-inch, and 3 in 6-inch, gave way and were replaced with iron plugs. A crack in 42-inch main necessitated putting on a bolted sleeve; a sleeve was also put on a 6-inch and an 8-inch pipe broken by the settling of a sewer ditch. A split in a 24-inch made it necessary to remove the whole length of pipe and replace it with a new one. We found 62 leaks on old abandoned service connections; 31 leaks were caused by electrolysis, 25 of them being on Jefferson avenue, 3 on Franklin, and 3 on Clark and River streets.

Of the 98 complaints of bad water, 12 were caused by dead ends, and cured by opening the blow-offs; 40 caused by sediment in the mains, and cured by flushing; 23 by foreign matter in service pipes, which were remedied by the use of force pump and flushing; 2 by having been tapped too low down on main pipe; 5 by leaks in service pipes; 3 by shutting and opening gates on mains; 1 by having service pipe connected with tank on roof, and 12 were found with no cause for complaint.

Had many of those who last year made complaint of "no water" been more circumspect, considerable trouble and expense would have been saved this department. Too many notify the Water Office of not having water when the slightest inspection by themselves would determine the cause and put the remedy in their own hands. Also in the matter of leaks; during the last month our men were called out on two different occasions in the middle of the night, and traveled two or three miles, only to find, on their arrival, a leak in the house that was stopped by just shutting off the stop in the cellar. If owners and occupants would only familiarize themselves with the water pipes in their houses, and find out how to control the fixtures, or the different branches therein, they would often save themselves, and the Water Works, much annoyance and expense. Among the 167 complaints of no water, 82 of them were caused by being shut off under sink or in the cellar, and 33 had no cause for complaint; the balance frozen, service pipe stopped with sediment, leak in service pipe, rods off from penstocks, etc.

Of the 77 complaints of short supply, 25 were caused by leaks in service pipe, 10 by sediment in service pipe, which was removed by use of force pump, 13 not turned on at stop full head, 9 service pipes too small, one had 23 feet of small rubber hose in service pipe (left there by some plumber who had the job of thawing out the pipe the winter before), 9 had no cause for complaint, the balance were caused from water running in closets or some leaking fixtures on the premises.

The following table will show much of the work done in this department during the past year:

STATEMENT OF LEAKS, COMPLAINTS, ETC., FOR THE YEAR 1896.

MONTHS.	LEAKS.			COMPLAINTS.				SHUT.				LET ON.				GATES.			Blow-offs Opened.	Pipes Frozen.	Service Pipes Disconnected.	Service-Crooks Replaced.	Stop-boxes Located.
	In Mains.	In Gates.	In Service Pipes.	No Water.	Bad Water.	Short Supply.	Water Running.	Vacant.	Non-Payment.	For Leak.	Miscellaneous.	Vacant. Re-occupied.	Non-Payment.	New.	Miscellaneous.	Opened.	Shut.	Found out of Order					
January	7	..	60	12	....	9	21	41	12	67	12	33	74	1	9	....	1	1	279	12	1	1	5
February	2	..	80	5	1	6	6	25	1	63	6	26	48	4	7	11	13	..	205	9	1	......	..
March	2	....	74	16	2	1	12	22	2	55	7	42	26	7	20	25	25	....	327	8	6	1	2
April	3	7	151	15	2	9	9	35	14	69	15	61	110	2	32	33	33	3	195	2	2	2	4
May	5	7	129	19	9	9	10	7	3	50	11	21	61	5	31	45	45	....	149	..	6	5	1
June	9	8	65	10	9	6	3	23	..	37	9	18	24	4	13	32	32	....	344	..	10	4	....
July	2	8	76	27	28	10	7	27	5	27	9	24	183	2	8	41	41		376	....	9	......	2
August	4	3	102	14	13	3	3	7	5	46	2	19	79	3	8	101	101	5	435	....	7	6	...
September	8	13	81	10	5	5	3	18	....	47	10	22	39	3	11	38	88	1	645	....	6	2	3
October	7	12	57	15	16	7	2	28	4	31	12	32	119	2	21	19	19	...	662	...	5	1	3
November	2	3	65	12	9	5	.	16	5	52	3	25	46	3	13	30	32	2	642	1	6	3	1
December	5	5	64	12	4	7	3	28	2	57	13	18	21	1	13	18	16	...	632	1	3	1	1
TOTALS	56	66	1,004	167	98	77	79	277	53	601	100	341	830	37	186	398	396	12	4,891	33	62	26	22
Totals for 1895	83	55	1,379	345	83	108	80	199	41	902	50	455	836	78	42	352	352	48	2,008	129	43	13	18

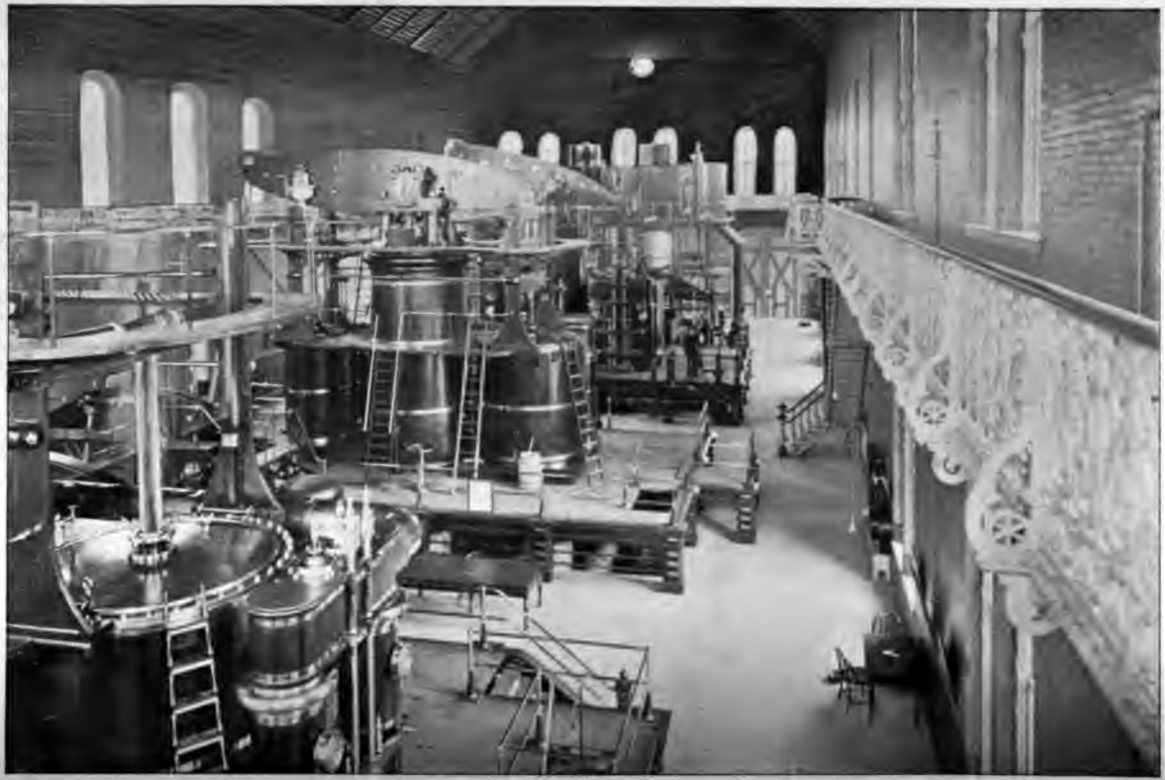
All repairs to pavements (which we have been obliged to remove in order to repair leaks) have been made by the Board of Public Works, from whom we have received very courteous and liberal treatment. Their inspector, George Pratt, who has been in charge of that portion of the work, is entitled to much praise for the close attention he has given to all back-filling and repaving. His only aim seems to be to see that both the Board of Public Works and Board of Water Works receive good and honest treatment.

Attached to this report is a complete list of tools on hand, and an itemized account of material in stock in the Meter, Service Cocks and Repairing Leaks Departments, on the 31st day of December, 1896.

In conclusion, I beg to thank your honorable body, the General Superintendent, and heads and employees of all the different departments, for the very kind and considerate treatment shown me during the past year.

All of which is respectfully submitted.

T. R. PUTNAM,
Supt. of Meters and Inspection.



THE ENGINE ROOM.

REPORT OF CHIEF ENGINEER AT PUMPING WORKS.

Detroit, January 1, 1897.

To the Board of Water Commissioners:

Gentlemen—I have the honor to submit the Engineer's report for the year 1896.

The following table shows the number of gallons of water pumped, and cost of fuel for the years named:

YEAR.	GALLONS OF WATER PUMPED.	COST OF FUEL CONSUMED.	AVERAGE DAILY DELIVERED.
1852	235,840,271	....	646,411
1853	303,531,743	$2,129 37	931,594
1854	376,265,126	2,271 34	1,030,866
1855	542,807,364	3,325 81	1,487,143
1856	692,124,305	4,017 44	1,896,231
1857	697,190,523	3,993 20	1,909,837
1858	718,091,207	3,655 20	1,967,373
1859	782,112,587	3,194 15	2,142,774
1860	870,036,451	4,196 21	2,383,580
1861	895,129,423	4,414 07	2,452,409
1862	994,945,329	3,150 95	2,725,878
1863	1,035,798,043	4,670 86	2,837,803
1864	1,018,390,256	7,647 62	2,839,078
1865	1,049,514,887	7,372 89	2,875,383
1866	1,196,317,922	9,349 16	3,277,583
1867	1,425,535,230	10,121 82	3.905,576
1868	1.666,545,125	11,379 23	4,507,248
1869	1,946,810,325	11,247 92	4,511,809
1870	1,866,060,068	12,713 78	5,112,493
1871	2,300,150,605	14,681 05	6,301,782
1872	2,782 292,578	17,736 86	7,601,892
1873	3,198,393,948	20,233 30	8,762.723
1874	3,289,872,635	20,431 71	9,013,350
1875	4,207,454,260	21,393 98	11,527,272
1876	4,065,134,470	19,832 89	11,107,499
1877	4,213,239,790	17,433 72	11,543,123
1878	4,345,743,330	10,943 82	11,906,146
1879	5,129,599,110	11,219 51	14,053,696
1880	5.552,965,310	12,276 60	15,172,036
1881	6,543,127,968	16,556 63	17,926,377
1882	6,284,000,742	13,156 16	17,261,440
1883	7,379,327,188	16,495 99	20,217,334
1884	8,510.614,140	19,877 07	23,253,044
1885	9,970,829,580	21,341 48	27,317,341
1886	10,576,571,254	20,387 24	28,976,907
1887	13,168,859,808	35,882 83	36,079,166
1888	14,380,166,670	39,568 66	39,397,716
1889	12,875,334,453	34,413 31	35,274,888
1890	12,120,944,532	31,852 40	33,209,067
1891	12,057,261,236	33,826 86	33,033,592
1892	12,476,612,482	31,034 40	34,182,499
1893	13,877,977,208	27,479 93	38,021,855
1894	13,649,779,605	29,283 47	37,396,656
1895	14,698,451,954	32,095 00	40,269,731
1896	13,254,369,371	31,186 17	36,214,123

The following tables show, in detail, the work done by each engine each month of the year:

ENGINE NO. 1.

MONTHS.	Time Run H.	Time Run M.	Revolutions.	Gallons Water.
January	593	25	326,101	395,649,372
February	114	35	68,104	61,512,174
March	237	35	134,470	117,020,490
April	664	....	395,488	472,441,761
May	367	25	225,422	257,516,792
June	181	50	104,890	133,984,674
July	110	20	60,110	53,982,540
August	338	05	188,656	218,520,110
September	443	15	251,185	332,680,082
October	458	35	215,788	315,100,986
November	330	05	177,130	206,597,934
December	524	25	297,019	296,712,840
Total	4333	35	2,471,372	2,901,770,658

ENGINE NO. 2.

MONTHS.	Time Run H.	Time Run M.	Revolutions.	Gallons Water.
January	476	35	290,376	441,039,552
February	623	45	406,283	522,315,216
March	726	55	464,610	592,016,904
April	72	..	45,585	62,093,880
May	551	05	352,369	474,770,616
June	720	..	469,155	625,218,120
July	720	....	475,581	590,740,056
August	440	..	282,055	378,188,808
September	15	....	8,780	12,399,640
October	...		......	....
November	158	55	91,112	95,491,416
December	486	05	297,152	475,169,040
Total	4,990	20	3,192,368	4,281,743,208

ENGINE NO. 3.

MONTHS.	Time Run H.	Time Run M.	Revolutions.	Gallons Water.
January		....	....	....
February	144	..	78,417	141,150,600
March	264	....	151,120	272,016,000
April	......	..	....	....
May	.....	..	....	....
June	....	...	....	....
July	.	..	....	......
August	336	....	195,501	351,901,800
September	720	....	416,380	749,484,000
October	744		408,140	734,652,000
November	717	10	398,050	716,490,000
December	232	20	137,055	246,699,000
Total	3,157	30	1,784,663	3,212,393,400

ENGINE NO. 4.

MONTHS.	Time Run H.	Time Run M.	Revolutions.	Gallons Water.
January	456	.	426,900	335,123,565
February	548	40	501,269	393,496,165
March	216	....	199,670	156,740,950
April	696	....	624,208	490,003,280
May	576	....	519,720	407,980,200
June	480	....	430,585	338,009,225
July	742	....	664,082	521,304,370
August	312	....	274,910	215,804,350
September	......	...	....	....
October	......	...	....	....
November	......	...	....	....
December	. ...	..	....	....
Total	4,026	40	3,641,353	2,858,462,105
Aggregate	16,508	05	11,089,756	13,254,369,371

604,943 gallons oil consumed.
$13,187.76, cost of oil consumed.
9,735,628 lbs. coal consumed.
$17,998.41, cost of coal consumed.
Total cost, $31,186.17

Fuel oil consumed	$ 13,187 76
Coal consumed	17,998 41
Salaries—Engineers and fireman	19,419 79
Consulting Engineer	1,000 00
Engine oil and waste	408 93
Repairs—Boilers and machinery	540 75
Supplies—Soap, polish, etc	120 54
Supplies—Valves, gaskets, packing, etc	191 46
Electric light supplies, etc	183 42
Street car, toll tickets, and telegrams	14 18
Medical services	1 00
Car rented	8 00
Farrier	6 30
Horse expense	144 64
Boiler inspection	48 00
Cartage	6 13
Expenses to Chicago and Saginaw	25 90
Alarms	64 00
Stationery	1 60
Ice	8 25
Total	$ 53,379 06

Cost of fuel, per million gallons pumped, has been $2.35.4, and per million gallons pumped 100 feet high, $2.18.8. Engines Nos. 1 and 2 were run a good part of the year with pumps single acting.

The tables show that the water pumped during the year was 13,254,369,371 gallons.

The total expense for pumping water was $53,379.06, making the cost per million gallons $4.02, which is an increase price per million over last year. This is accounted for by the high price of fuel consumed the first nine months of the year, which the following table will show:

COST OF FUELS TO PUMP 1,000,000 GALS. OF WATER 100 FEET HIGH.

Fuel oil at .02.18 cents per gal	$ 2 78
Anthracite coal at $4.37 per ton	2 40.4
Bituminous coal at $2.60 per ton	1 31

In figuring the cost for fuel, there has not been any deduction for heating, lighting, or banking fires.

The Commissioners contemplated using bituminous coal as fuel. In June there were delivered and tested at this Pumping Station 25 tons of four grades of bituminous coal and one grade of anthracite coal which we had on hand, with the following results:

LBS. OF WATER EVAPORATED TO 1 LB. OF COAL.

	Actual Conditions.	From and at 212° Fah.
Congo coal	6.77 lbs.	7.71 lbs.
Peerless Riverside coal	8.00 lbs.	9.12 lbs.
Anthracite coal	8.75 lbs.	9.93 lbs.
New River coal	9.22 lbs.	10.51 lbs.
Pocahontas coal	9.42 lbs.	10.73 lbs.

Feed water measured by meter.

After results of tests being reported the contract for 5,000 tons of Pocahontas coal was made. The figures show a saving while using bituminous coal for the last three months of 49.4 per cent over fuels consumed the first nine months of the year. By continuing the use of bituminous coal at contract price, it will be readily seen a good reduction in the price of pumping water will be made.

The new coal-handling device, which was placed in position the past year, is a good improvement in appearance over the former one.

The four Wood water tube boilers built by Wickes Bros. were placed in position and subjected to a hydraulic pressure of 225 pounds and pronounced O. K.

Nov. 3 and 4 a satisfactory test was made to determine their guaranteed efficiency and economy. The following table will show results of tests made:

	ECONOMY GUARANTEE.	CAPACITY GUARANTEE.
Date of trial	November 3, 1896.	November 4, 1896.
Duration of trial	10 hours.	10 hours.

DIMENSIONS AND PROPORTIONS.

	ECONOMY GUARANTEE.	CAPACITY GUARANTEE.
Kind of grate	Wickes rocking.	Wickes rocking.
Grate surface—width by length and area	6 x 6 ft—36 sq. ft.	6 x 6 ft—36 sq. ft.
Water heating surface	2,200 sq. ft.	2,200 sq. ft.
Superheating surface	168.24 sq. ft.	168.24 sq. ft.
Area of chimney	19.635	19.635
Height of chimney	120 ft.	120 ft.
Ratio water heating surface to grate surface	61.1 to 1.	61.1 to 1.
Ratio air space to grate surface	1 to 2.	1 to 2.

AVERAGE PRESSURES.

	ECONOMY GUARANTEE.	CAPACITY GUARANTEE.
Steam pressure in boiler by gauge	62.01.	62.05.
Absolute steam pressure	76.507.	76.406.
Atmospheric pressure per barometer	29.406—14.497.	29.12—14.356.
Force of draft in inches of water	.39.	.399.

AVERAGE TEMPERATURES.

	ECONOMY GUARANTEE.	CAPACITY GUARANTEE.
Of external air	54.9.	55.3.
Of fire room	72.8.	74.1.
Of escaping gases	355.5.	404.
Of feed water	54.1.	54.2.

FUEL.

	ECONOMY GUARANTEE.	CAPACITY GUARANTEE.
Kind of coal	Pocahontas Lump.	Pocahontas Lump.
Total amount consumed	6,400 lbs.	7,244 lbs.
Moisture in coal	2 per cent.	2 per cent.
Dry coal consumed	6,272 lbs.	7,099.12 lbs.
Total refuse	196 lbs.—3.12 pr ct.	350 lbs.—4.9 pr ct.
Total combustible	6,076.	6,749.12.
Dry coal consumed per hour	627.2.	709.912.
Combustible consumed per hour	607.6.	674.912.

RESULTS OF CALORIMETRIC TESTS.

	ECONOMY GUARANTEE.	CAPACITY GUARANTEE.
Quality of steam	99.68.	99.77.
Percentage of moisture	0.32 per cent.	0.23 per cent.

WATER.

	ECONOMY GUARANTEE.	CAPACITY GUARANTEE.
Total weight of water pumped into boiler	58,828.	64,065.
Water actually evaporated, corrected for quality	58,639.75.	63,877.7.
Factor of evaporation	1.195.	1.195.
Equivalent evaporation from and at 212 degrees	70,074.50.	76,333.85.
Equivalent evaporation from and at 212 deg. per hour	7007.45.	7633.385.

ECONOMIC EVAPORATION.

	ECONOMY GUARANTEE.	CAPACITY GUARANTEE.
Water actully evaporated per pound dry coal, actual temp. and pres	9.38.	8.99.
Water evaporated per lb. dry coal from and at 212 deg. Fah	11.17.	10.75.
Water evaporated per lb., combustible from and at 212 deg. Fah	11.53.	11.31.

	ECONOMY GUARANTEE.	CAPACITY GUARANTEE.
RATE OF COMBUSTION.		
Dry coal burned per square foot grate per hour..	17.4.	19.71.
Dry coal burned per square foot water heating surface per hour..	.285	.322.
RATE OF EVAPORATION		
Water evap. from and at 212 deg. per sq. ft. water heating sur. per hour..	3.18.	3.46.
Water evap. from and at 212 deg. per sq. ft. grate surface per hour	194.6.	212.05.
NUMBER OF HEAT UNITS.		
No. heat units in one lb. of coal, estimated by Barrus, max. and min ..	13,608 to 14,603	13,608 to 14,603.
No. heat units transmitted to water per lb. of coal	10,786.	10,381.
Efficiency of boiler	73 pr ct. to 78 pr ct	71 pr ct. to 76 pr ct.

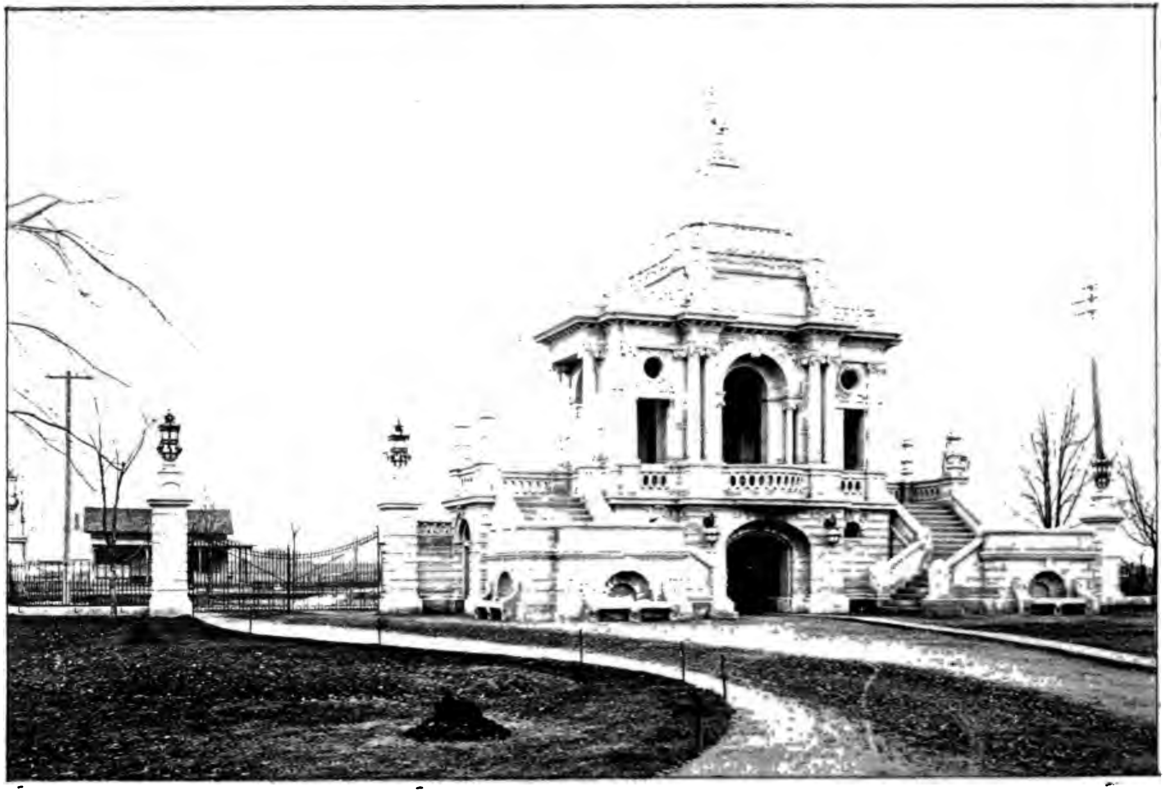
The engine house and coal sheds are in the same condition as formerly.

The engines are in good condition, although but slight repairs have been made to them the past year.

The four boilers in the east room had some needed repairs this spring. All of the boilers are now in good condition.

Transmitted with this report is an inventory of tools and stock on hand. Respectfully submitted,

URIAH GOULD,
Chief Engineer of Pumping Station.



THE HURLBUT MEMORIAL GATEWAY.

REPORT OF THE SUPERINTENDENT OF GROUNDS.

Detroit, Mich., December 31, 1896.

Hon. Board of Water Commissioners:

Gentlemen—The permanent improvements completed the past year go far towards giving the grounds that finish necessary to place it in the front rank with parks of equal area.

The improvements now needed are a suitable greenhouse, also team and foot bridges over the winding canal, which I hope your honorable body will conclude to construct the coming season.

The attendance has been large, and both our own citizens and visitors from other places have spoken in the highest terms of the different floral designs and the general appearance of the grounds.

Next season I hope to improve upon former efforts in the line of floral displays. Although short of room, I think by the use of more hotbed sash we may be able to grow sufficient plants.

The earth excavated when deepening the water in the canal was removed to the west bank of the cut opposite the south end of the dock, and answers the two purposes of protecting the cut from filling up, and also makes an island of 4,000 square feet, that will further beautify the river front.

The space east of the dock, where the inlet pipes are laid, is very difficult to improve, but I hope to keep it in neater condition than heretofore.

Upon instructions of the General Superintendent I erected the large tent belonging to the Board, placing a floor therein and seats sufficient to accommodate forty persons, on the bank of the west lake. This is intended for the use of skaters, and since the completion of the lighting plant many are availing themselves of the privilege during the evenings. Much pleasure has been expressed by visitors in regard to this improvement.

I enclose an invoice of the movable property in this department, valued at $1,565.79.

Very respectfully,

E. A. SCRIBNER,
Supt. Grounds.

REPORT OF THE SUPERINTENDENT OF EXTENSIONS.

Detroit, Mich., January 2nd, 1897.

To the Honorable Board of Water Commissioners:

Gentlemen—In accordance with the regulations of the Board of Water Commissioners I have the honor of presenting to you my annual report, relative to the general condition and progress of the work in this department.

In making out this, my annual report, I have taken the liberty of trespassing a little upon this present year, for the reason that the extensions we are now at work upon, and which will be completed during the early part of January, were commenced during the month of December. This, when completed, with the past year's work to January 1st, 1897, will make the mileage for the year 21¾ miles, being less 1¼ miles than for the previous year.

The calls for extensions by petitions for the year just closed were not as numerous as in previous years. The cause, I suppose, may be attributed to the very stringent times. Quite a few of the petitions presented, requiring the payment of a bonus, were not complied with. The reason, no doubt, was the failure to meet the bonus, which was large on account of the lines being lengthy and costly.

The total mileage laid to meet the petitions and ordered laid was $3\frac{2072}{5280}$ miles. The amount called for but not laid was $1\frac{4001}{5280}$ miles.

New 30-Inch Supply Main.

Added to our pipeage system has been the laying and completing of an additional 30-inch main. Nearing the close of the year the order was given for the laying of this main. On the 5th of October last the ground was broken and the work upon the same pressed along as rapidly as circumstances would allow. The line is laid for the readjustment of the flow through the upper 42-inch main in Canfield avenue, and takes a very circuitous route which covers a distance of one mile. This line will take its supply from the 30-inch main in Scott street, connecting with this main at the intersection of Scott and Orleans street, from which point it takes its course, to Hale street; thence westward in Hale street to Riopelle street, and in Riopelle street north to Rowena street; thence running westward in Rowena street to Russell street, and from this point north in Russell street to Brady street; thence west in Brady street to Rivard street, and again north in Rivard street from Brady street to Alexandrine avenue, and from which point the line takes a westerly direction in Alexandrine avenue to alley east of St. Antoine street; thence north in said alley to the upper 42-inch main in Canfield avenue, at which point this line of 30-inch connects with 42-inch mains, and to which line of 30-inch main the entire street lines crossing the same have been connected thereto. An improved system of blow-offs has been connected with the same.

The following are the principal lines laid for general distribution and the replacing of smaller lines of pipe:

A continuous line of 8, 10, 12 and 16-inch main was laid in the following manner at the intersection of Watson and Brush streets: The line of 16-inch connects with the Watson street 24-inch main, from which point in the west lawn on Brush street it runs north to Erskine street; thence westerly in Erskine street to the east lawn in Woodward avenue, and in said east lawn to Stimson place, and in line of Stimson place from east lawn to the 10-inch pipe in line of Woodward avenue, connecting with the same; from this point the line is reduced to 12 inches, taking a westerly course through Stimson Place to the east lawn in Cass avenue, in which lawn it runs to Pitcher street; thence westerly in Pitcher street to Second avenue, at which point the line is reduced to 10 inches, which again takes westerly course to the west lawn in Third avenue; from this point in the said lawn the line runs north to Selden avenue, where is it again reduced to 8 inches, and in Selden avenue this size pipe is laid from Third to alley east of Trumbull avenue. In Jefferson avenue several lines of 6, 8 and 10-inch pipe have been laid to dispense with some of the old line of 10-inch lying between the car track from St. Antoine to Orleans streets. The lines were laid in the north and south lawns. So as to avoid the effects of electrolysis which has affected the lead service pipe leading to the buildings, a line of 6 and 8-inch was laid in north lawn of said avenue from west of Leib street to Beaufait avenue.

A continuous line of 8 and 10-inch pipe was laid in the following streets, connecting with the 12-inch main in Gratiot avenue: A line of 10-inch runs north to High street, in which street the 10-inch line continues to Rivard street, from which point it runs north in Rivard street to Winder street, and from this point an 8-inch pipe runs north in Rivard street to Division street; thence westerly in Division street to Hastings street, and again north in Hastings street to Alfred street, and in Alfred street west to St. Antoine street.

An 8-inch line was also laid in the following streets: Blaine avenue east of Hamilton Boulevard, Melbourne avenue west of Woodward avenue, Gratiot road from city limits to French road, Leib street from Jefferson avenue to Congress street, Jay street from Second to Cass avenues, and in Catherine street from Joseph Campau to the west lawn in McDougall avenue, thence south on McDougall avenue to Clinton avenue. These, with many of the 6-inch lines, have taken the place of some of our 3 and 4-inch pipe lines.

Lowering of No. 1 42-inch Main.

Owing to the building of an outlet to the river for a new system of sewerage in the easterly end of the city, a few blocks west of the Pumping Works grounds, it became necessary to lower a portion of our lower, or No. 1, 42-inch main, for the reason that the sewer had to cross this main. The lay of the land at this section in line of Jefferson avenue is such that to pass over our main would cause the sewer to rise above the roadway, and to pass below would cause a very objectionable obstruction to a free outflow of the sewage.

The sewer is so constructed with four cylinder openings that the height is reduced to a minimum; so, in view of this fact, it became apparent that to avoid such an objectionable obstruction to its free flow, the line of main was lowered. To do this, and in the manner decided, required an opening of the pipe trench a distance of 600 feet. About 350 feet of this length was lowered to a depth of 4 feet below its original depth, and on a level plane. At each end covering the 250 feet the incline, or slope of the pipe, was made to conform to a reversed curve. To lower the main to this depth, we dug the trench of sufficient width to allow the men to work on either side and to excavate under the pipe, and so by degrees we lowered the same to its desired depth, which was very successfully done, notwithstanding that an 8-inch stream was allowed to flow through the by-pass, to supply one of the streets running north of the same. After properly bedding the main, the joints were recalked. In so doing two of the bells were cracked, which caused the rupture of one of the pipes. This was cut out and replaced with a new length. I am sorry to say that two of the men met with a severe accident while engaged on this work.

Pipeage.

The amount of distribution pipe and mains laid and relaid, also for private and minor usage and for small lines of pipe discontinued during the past year, makes the sum total as follows: Total pipe laid, $21\frac{3650}{5280}$ miles, of which 673 feet was laid for private use, and 4,585 feet for all minor usages. Blow-offs, electric conduits, drainage, relaid pipe, and for fire and flushing hydrants, $5\frac{70}{5280}$ miles of pipe discontinued, making the net increase of the pipeage $15\frac{3687}{5280}$ miles. This amount, added to the measured lines of pipe connected with the Works, will make the total length $517\frac{312}{5280}$ miles, which, in detail, will be seen in the following table of pipeage:

Size of Pipe in Inches.	Measured Length in Feet for 1895.	Added Length in Feet for 1896.	Discontinued Length in Feet for 1896.	Total Length in Feet for 1836.
45	103	....	....	103
42	59,509	13	31	59,491
36	715	....	....	715
30	49,315	5,179	66	54,428
24	84,841	....	478	84,363
20	461	....	355	106
18	87	....	....	87
16	45,237	2,853	22	48,068
12	17,018	5,984	....	23,015
10	137,684	8,938	2,806	143,816
8	279,490	14,491	118	293,813
6	1,103,673	68,391	1,576	1,170,502
4	794,908	2,396	15,408	781,896
3	71,437	....	5,648	66,790
2	2,820	....	....	2,820
TOTAL....	2,647,298	108,245	26,508	2,720,013

The mileage of the city equals 1.88 miles per 1,000 inhabitants, estimating the population of the city at 275,000.

TABLE OF PIPEAGE AS ARRANGED BY WARDS.

WARD.	4-IN.	6-IN.	8-IN.	10-IN.	12-IN.	16-IN.	18-IN.	20-IN.	24-IN.	30-IN.	36-IN.	42-IN.	45-IN.	2-IN.	3-IN.	LEAD.	TOTALS.	Feet Discontinued.	Feet Added.
First	60,692	65,480	26,190	29,478	2,600	17,611	......	......	6,741	3,934	......	2,340	......	......	5,252	......	220,327	1,357	5,190
Second	38,476	52,662	14,556	19,771	2,361	8,198	......	......	5,913	4,184	......	......	......	......	1,788	......	147,909	6,552	7,509
Third	37,835	43,573	10,296	8,075	1,933	3,264	......	......	4,548	3,801	......	1,661	......	......	4,513	......	119,499	1,884	3,807
Fourth	62,260	60,689	8,705	6,034	......	3,556	......	......	5,323	3,253	......	......	......	......	5,239	......	155,059	2,888	6,832
Fifth	53,838	30,183	11,491	10,703	985	2,469	......	......	3,673	4,868	......	1,749	......	......	4,205	......	134,164	4,243	8,421
Sixth	45,211	41,552	20,594	5,946	2,426	1,565	......	......	5,483	2,533	......	......	......	......	4,742	......	130,052	1,335	3,183
Seventh	45,225	28,315	19,314	4,168	2,514	802	......	361	11,019	4,505	......	1,829	......	......	1,663	......	119,715	2,344	6,259
Eighth	47 963	59,225	21,656	161	2,372	......	......	......	8,277	2,153	......	......	......	......	7,508	175	149,490	592	1,356
Ninth	58,985	71,198	12,622	5,433	1,815	3,430	......	......	2,433	12,041	715	3,401	......	......	6,021	......	178,094	958	2,621
Tenth	81,172	83,585	18,612	8,906	230	......	......	......	10,967	2,443	......	......	......	......	4,421	......	210,336	10	186
Eleventh	56,488	57,870	7,254	3,638	20	......	......	......	1,463	......	......	4,955	......	......	6,050	16	137,745	1,157	1,534
Twelfth	28,698	79,077	21,860	3,951	16	140	87	55	7,003	2,593	......	......	......	......	2,562	......	146,042	1,219	4,342
Thirteenth	60,899	67,289	9,995	5,002	51	......	......	......	513	7,173	......	9,982	......	......	6,708	......	167,615	649	9,146
Fourteenth	34,968	100,435	22,562	5,241	......	2,685	......	......	11,203	1,013	......	......	......	......	2,557	160	180,824	585	2,462
Fifteenth	39,172	166,299	38,565	13,080	1,489	......	......	......	28	......	......	33,565	103	2,820	712	213	296,046	110	7,183
Sixteenth	23,892	111,339	18,848	10,772	......	3,533	......	......	......	......	......	......	......	......	1,718	......	170,102	24	5,223
Outside City Limits	6,001	51,689	10,743	3,457	4,200	815	......	......	......	......	......	......	......	......	80	......	76,985	......	32,976
Totals in feet	781,775	1,170,460	293,863	143,816	23,015	48,068	87	416	84,587	54,494	715	59,491	103	2,820	65,739	564	2,730,013	25,907	108,230

The lowering of the 42-inch main in Jefferson avenue and the making of the final connections of the mains in Pumping Works grounds are not included in the above pipeage.

The total weight of pipe of all sizes used on the work the past year equals 2,875.25 tons. This does not include specials. Thirty-five tons was of 2, 3 and 4-inch pipe. The 2-inch was new and was laid for private use. The 3 and 4-inch was old stock, having been in use before. Eight hundred and fifty-eight and seventy-five hundredths of the tonnage was of 16, 30 and 42-inch, leaving a balance of 1,981.5 tons covering the 6, 8, 10 and 12-inch pipe of the ordinary extensions.

Pipe Extensions Laid Beyond the City Limits.

No less than $6\frac{758}{5280}$ miles have been laid. Of this amount, $5\frac{2224}{5280}$ miles were laid in the village of Highland Park, ranging in size from 6 to 16 inches. A line of 16, 12 and 10-inch was laid in Woodward avenue, from which the following 6-inch branch lines were laid: Tuxedo avenue from Woodward to Hamilton Boulevard and 233 feet north on Hamilton Boulevard, Cortland avenue from Woodward avenue to Hamilton Boulevard, Highland avenue from Woodward avenue to Hamilton Boulevard, Glendale avenue from Woodward avenue west 4,002 feet, Farrand avenue east from Woodward avenue 760 feet, Buena Vista avenue east from Woodward avenue 2,312 feet, Gerald avenue east from Woodward avenue 2,657 feet. The 16-inch main extends from the city limits to Monterey avenue, and from this point the 12-inch extends to Gerald avenue, and from which point the 10-inch extends to Moss avenue. Twenty-one fire hydrants and 34 gates were set, 8 of which were set for blow-offs. Seventeen hundred and forty-six feet of 6-inch was laid in St. Clair Heights, and

3,009 feet of 8-inch was laid in line of Gratiot road in Leesville from Harper avenue to French road; also, 876 feet of 4-inch was laid in West End avenue, north of River street, Delray. The above constitutes the lines laid beyond the city limits, the total cost of which was met by petitioners.

The following table gives a lucid statement of the average cost of each size of pipe and main as laid, also cost per foot and pro rata of per cent of total cost of the extensions, for the past season's work:

TABLE OF PRO-RATA OF PER CENT. OF TOTAL COST, COST PER FOOT, AND TOTAL COST OF EACH LINE AS LAID THE PAST YEAR.

DIAM. OF PIPE IN INCHES.	Pro-Rata of Per Cent. of Total Cost.	Total Cost of each Size of Pipe Laid.	Total Length in Feet.	Cost per Foot.
42	....	....	.. ..	....
30	.2452	$33,663 50	5,179	$6 50
16	.0727	9,935 50	2,853	3 50
12	.0768	10,537 22	5,987	1 76
10	.0898	12,334 44	8,938	1 38
8	.1181	16,329 92	14,491	1 12
6	.3895	53,426 10	68,495	78
4	.0079	1,078 20	2,396	45
TOTAL...	1.0000	$137,304 88	108,272	

It may be of interest to give the location of a number of new streets that have been added to the city, and in which distribution pipe has been laid. The following are the names and locations:

Brownlee Place, north of Stanley avenue.
Buena Vista avenue, east of Woodward avenue.
Cortland avenue, west of Woodward avenue.
Farrand avenue, east of Woodward avenue.
Gerald avenue, east of Woodward avenue.
Glendale avenue, west of Woodward avenue.
Highland avenue, west of Woodward avenue.
Jean avenue, east of Gratiot avenue.

Newland avenue, north of Gratiot avenue.
Richard street, west of Seyburn avenue.
Scheffer Place, west of Moran street.
Tuxedo avenue, west of Woodward avenue.
West End avenue, north of River road.

Buena Vista, Cortland, Farrand, Gerald, Glendale, Highland and Tuxedo avenues are located in the village of Highland Park, and West End avenue is in Delray. The rest are within the city limits.

To this report I again append the number of hydrants and reservoirs added to the pipeage this year, as follows: Hydrants, 130; reservoirs, 21; making the total now in use 2,724 hydrants and 562 reservoirs.

42-Inch Main from Pumping Works Grounds.

In referring to the annual report for 1895, page 124, will be found the statement that we were then at work making our final connection with the engines and mains at this place. This was very satisfactorily completed, and to accomplish the same was of no mean order, requiring special care and skill in the handling and supervision of the work. A view of the work before covering with the earth would be very convincing of the fact. Three new hydraulic gates were set on this work; also the taking up and re-locating of one of the Flower Bros.' gates and the placing of six 42x42-inch "Y" branches. The back-filling of the ground over the excavations was put back in good order. Immediately following this work, and at said place, a system of drainage pipe was laid, for the purpose of draining the entire arrangement of the gate wells, about 879 feet being laid for this purpose, and of sizes from 4 to 12-inch diameter. Branch connections were made with each well and drain pipe, the main line running into the engine house, connecting with the main feed pump, located between

Engines Nos. 1 and 2, for displacing the surface water percolated through the area of the grounds in which the gate wells are located. The wells of these hydraulic gates have a depth of 6 to 8 feet below datum height of the river.

There is also a connection to the 24-inch blow-off pipe in rear of the standpipe, which carries off any accumulation of water rising above the level of the river. Gates are placed on each of the wells, so that any one of the wells may be pumped out independently of the others.

There was also laid in said grounds, for conduits for conveying the wires of the electric plant, 1,564 feet of 2½-inch wrought iron pipe, 1,398 feet of 3-inch and 411 feet of 4-inch cast iron pipe.

Old Reservoir Grounds.

The taking down of the old reservoir embankment has given us an opportunity of taking up quite a few feet of 20 and 24-inch pipe; also a number of specials and gates. The amount of pipe taken up equals 833 feet, of which 478 feet were of 24-inch and 355 feet of 20-inch, four 24-inch and one 20-inch water gates; of specials, two 24-inch sleeves, one 20-inch and one 24-inch cap, one 24x24-inch cross, one 24x24 and one 24x20-inch tees; and from which 3,192 pounds of lead were taken from the joints. The work has cleared over 100 per cent. of the cost of labor.

Storage Grounds.

Two hundred feet of 6-inch pipe were laid in said grounds, to which two fire hydrants have been attached for fire protection and other usage. A large shed of undressed lumber was built adjoining the R. R. siding near the entrance to the grounds, for the housing of our building materials, brick, sand, lime and cement. We find this of much advantage in the protection of this material. At the said grounds, and in the lawn adjoining the storage-keeper's house, a rather sightly looking fountain was built by our men. The basin has an inner diameter of 8 feet. The said fountain is built up of concrete, and broken brick for its base, the inner surface being plastered over with Portland cement, swept up with template. The outside of the basin is banked up at an angle of 45 degrees and sodded, rising 20 inches above the ground. The center piece is built out of water pipe, with an ornamental fixture on top.

Storage Department.

The numerous items of material needed for our extensions and constructions coming under this head, and the care of the teaming, has been very efficiently met by Mr. W. J. Woodhouse and his corps of helpers.

TABLE OF NEW GATES SET FOR SHUT-OFFS.

No. of Each Kind.	NAME OF GATE.	Size.	REMARKS.
8	**Michigan Brass & Iron Works**	30-in.	Set for Shut-off.
1	" " " "	20-in.	" "
3	" " " "	16-in.	" "
2	" " " "	12-in.	" "
21	" " " "	10-in.	" "
55	" " " "	8-in.	" "
202	" " " "	6-in.	" "
8	" " " "	6-in.	Set for Blow-off.
6	" " " "	4-in.	Set for Shut-off.
1	**Murdock Valve Company**	12-in.	" "
2	" " "	10-in.	" "
4	" " "	8-in.	" "
9	" " "	6-in.	" "
34	" " "	4-in.	" "
19	" " "	4-in.	Set for Blow-off.
2	**Galvin Bros**	4-in.	Set for Shut-off.
1	" "	4-in.	Set for Blow-off.
396	Total.		

TABLE OF OLD GATES RE-SET FOR SHUT AND BLOW-OFFS.

No. of Each Kind.	NAME OF GATE.	Size.	REMARKS.
5	**Michigan Brass & Iron Works**	6-in.	Re-set for Shut-off.
2	**Murdock Valve Company**	6-in.	" " "
8	" " "	4-in.	Set for Blow-off.
15	" " "	4-in.	Set for Shut-off.
1	" " "	4-in.	Re-set for Shut-off.
9	" " "	4-in.	Re-set for Blow-off.
3	**Ludlow**	4-in.	" " "
2	**Flowers Bros**	30-in.	Re-set for Shut-off.
1	" "	4-in.	" " "
46	Total.		

TABLE OF GATES TAKEN OUT.

No. of Each Kind.		Size.
1	**Flower Bros**	**30-in.**
12	" "	**4-in.**
2	**Murdock Valve Company**	**8-in.**
1	" " "	**6-in.**
27	" " "	**4-in.**
1	**Pittsburgh**	**6-in.**
1	**Michigan Brass & Iron Works**	**6-in.**
2	" " " "	**4-in.**
4	**Galvin Bros**	**4-in.**
2	**Pittsburgh**	**4-in.**
4	**Ludlow**	**4-in.**
7	**No Name**	**4-in.**
64	**Total.**	

The following table gives the total number of water gates in the pipeage system, name and maker, number of each size, and percentage of each manufacture:

GATES IN SYSTEM TO JANUARY 1st, 1897.

	42 In.	36 In.	30 In.	24 In.	20 In.	18 In.	16 In.	12 In.	10 In.	8 In.	6 In.	4 In.	3 In.	Total.	Per Cent.
Murdock	5	....	11	16	....	....	24	28	169	437	1,490	1,251	9	3,440	55.736
Flowers	20	....	9	18	....	....	....	....	39	52	241	435	22	836	13.545
Galvin	....	1	7	12	....	....	21	....	12	32	171	267	1	524	8.490
Mich. Brass and Iron Works	10	....	9	2	11	....	10	10	47	142	711	111	...	1,063	17.223
Pittsburgh	....	....	....	13	....	2	1	1	9	11	30	127	...	194	3.143
Eddy	....	....	....	....	....	....	....	....	15	4	6	9	...	34	.551
Scowden	....	....	....	....	....	....	....	....	3	2	....	....	...	5	.081
Ludlow	....	....	....	....	....	....	....	....	1	3	11	12	...	27	.437
Prong	....	....	....	....	....	....	....	....	....	....	1	....	...	1	.016
Boston	....	....	....	....	....	....	....	....	....	1	1	....	...	2	.032
Newport	....	....	....	....	....	....	....	....	....	....	....	1	...	1	.016
No Name	....	....	....	....	....	....	....	....	....	3	9	32	1	45	.730
Total	35	1	36	61	11	2	56	39	295	687	2,671	2,245	33	6,172	100.000

Testing Department.

I am very much pleased to say that the change made in this department, and the labors pertaining thereto, have been very satisfactorily met. The change made at the opening season's work cannot be too highly commended. Two hundred and thirty-nine calls were made, and 212 successful tests were made upon the pipe lines between the months of April and December. One hundred and forty-one of the old gates of different sizes have been repaired and tested, 125 of which have been sent out on the different lines for blow-offs. To this have been added the renovating and storing away bolts for 35 of our bolted sleeves. The tools pertaining to this department have been kept up in good order.

Gate Department.

The work of this department has been very efficient in meeting the numerous calls which are made upon it. It is only necessary to read over the following condensed statement of its work, as appearing in the following report:

2,046 gates were examined.
509 reported out of order January 1st, 1896.
201 were found out of order since January 1st, 1896.
583 were repaired.
41 were found shut, and opened.
184 were fitted with larger heads to stem.
290 new gates were opened.
61 gate wells were built.
219 gate wells were rebuilt and adjusted.
68 gate wells were cleaned out.
205 wood boxes were replaced with iron boxes.
787 boxes were readjusted to grade of street.

2,961 gates were shut and opened for various purposes.
79 blow-offs were repaired.
6,499 gate wells and boxes cleaned of snow and ice.

In addition to the above mentioned, there have been the building of a number of brick piers, abutments and breastwork under and around the 42-inch mains in the Pumping Works grounds. The building of a number of brick wells for the electric lighting system at said place, and to which may be added several meter wells, and the refilling of concrete foundations for asphalt pavements in the trenches where water pipes and mains were laid.

It is very gratifying to be permitted to state that the business transactions between this department and that of the Board of Public Works have been very harmonious. Much credit is due Mr. George Pratt, who is the special inspector appointed by that body over our extension and repairs. His ability as an inspector of this class of work which comes under his supervision has made it very pleasant for us in the prosecution of our work, thus avoiding much unnecessary friction to this and the other departments of our Works.

Office of Extension Department.

I am pleased to say that the clerical labor of this office, under the efficient supervision of Mr. A. W. Goodsell, with his corps of assistants, has been very satisfactory. It would be a breach of courtesy did I fail to mention the valuable services rendered the department by Mr. F. B. Egan, my assistant. The co-operation with the several departments of the Works has been very harmonious. In conclusion I wish to return my grateful thanks for your kindness and forbearance of the numerous calls this department had to make upon your attention.

Transmitted with this report is an inventory of tools, pipe and specials, office equipments, location of the pipeage, and changes in street names; also streets newly opened, located by wards and precincts, to January, 1897.

Respectfully submitted,

HENRY BRIDGE,
Superintendent of Extensions.

VALUATION OF THE WORKS.

AGGREGATES.

Real estate	**$**	**423,577 29**
Oil plant		**13,184 37**
Buildings, docks, basins, conduits, force mains at Pumping Works		**987,384 81**
Water pipe laid and in use		**3,604,201 65**
Meters placed and in use		**97,484 65**
Horses, vehicles and harness		**7,030 00**
Office furniture and fixtures		**15,384 36**
Tools and materials on hand:		
In Repair Department		**583 76**
In Meter Department		**2,705 39**
In Service Connection Department		**1,712 05**
In Iron Pipe Department		**44,086 15**
In Pumping Water and Works Department		**29,355 16**
In Hurlbut Fund Department		**1,565 79**
Aggregate		**$5,228,255 43**

The above valuation consists, in detail, as follows:

REAL ESTATE.

Office building and lot	**$** 60,000 00	
Orleans street lots	33,750 00	
Storage grounds and improvements	53,450 00	
Pumping Works grounds and improvements	276,377 29	
		$423,577 29

OIL PLANT.

Pumping Station house, engines and pipe tank and fixtures at Works	**13,184 37**

PUMPING WORKS.

Buildings, dock, basin, conduits, pipe, etc.	**$**987,384 81
Tools	1,084 72
Materials—Rope, waste, etc	1,313 68
Materials—Gauges, valves, etc	920 20
Materials—Iron, lead, etc	551 66
Furniture	288 05

Wood and coal	$ 10,774 60	
Hoisting engines, pony pumps and boilers, electric light plant and stock, gas machines, hoisting apparatus, etc	14,422 25	
Tools, materials and settees, Hurlbut Fund	1,565 79	
		$1,018,305 76

OFFICE BUILDING.

Counter	in office	$ 1,000 00
Fourteen office tables	“ “	215 00
Six book cases	“ “	660 00
Three wardrobes	“ “	335 00
Ten desks	“ “	262 00
Thirty-seven chairs	“ “	105 00
Thirteen office stools	“ “	40 00
Two city maps	“ “	40 00
Map case	“ “	75 00
One marble clock	“ “	100 00
Four atlas maps	“ “	80 00
Partitions and railings	“ “	800 00
Heating apparatus	“ “	1,400 00
Electric light fixtures	“ “	150 00
Miscellaneous properties	“ “	135 00
Furniture in Board Room		575 00
Furniture in Secretary's room (excepting desk) in office		91 00
Two book stands in office		5 00
Annunciator in office		40 00
Engineering instruments	in engin'r'g dept.	998 00
Old maps, plats and records	“ “	1,500 00
New maps, plats and records	“ “	5,500 00
Two city plat books	“ “	100 00
Three cases for maps and drawings	“	170 00
Eight draughting tables	“ “	100 00
Ten stools	“ “	28 00
Draughting boards, tables and horses	“	30 00
Blue printing outfit	“ “	50 00
Roll top desk, table and 6 chairs	“	78 00
Tee squares, straight edges, etc.	“	10 00
Bicycle	“ “	50 00
Safe	“ “	50 00
Books and papers	“ “	50 00
Paper, tracing cloth and supplies	“	60 00
Eight desks	in Supt. of Ex. room	145 00
One table	“ “ “ “	4 50
Thirteen chairs	“ “ “ “	38 00
One copy press and stand	“ “ “	10 00

Eight inkwells	in Supt. of Ex. room	$ 6 00	
One clock	" " " "	12 00	
Numbering stamp	" " " "	15 20	
One wash stand	" " " "	26 66	
Blanks and stationery	" " " "	20 00	
Three bicycles	" " " "	225 00	
			$15,384 36

REPAIR DEPARTMENT.

2 sleighs	$25 00
2 sets runners	20 00
5 horse blankets	17 00
3 sets calking tools	1 50
290 lbs. pig lead	8 12
1474 lbs. scrap lead	41 27
15 lbs. sheet lead	75
18 lbs. ½x½ solder	1 89
200 lbs. wiping solder	16 00
88 lbs. 1½-in. lead pipe	3 52
600 lbs. 1-in. lead pipe	24 00
45 lbs. ¾-in. lead pipe	1 80
277 lbs. ⅝-in. lead pipe	11 08
8 ladles	12 00
1 plumber's fire pot	5 00
12 diamond-pointed chisels	12 00
12 flat chisels	6 00
1 anvil	2 50
2 vises	8 00
30 gate keys	35 00
14 street keys	14 00
4 pumps	70 00
12 hydrant wrenches	4 50
6 dippers	2 00
5 pairs rubber boots	15 00
2 leather jackets	6 00
12 shovels	5 00
12 picks	12 00
6 pounders	6 00
19 lanterns, 16 red globes	18 00
1 saw	75
1 draw knife	50
1 rope ladder	1 00
1 platform scale	25 00
2 force pumps	8 00
1 grindstone	1 25
7 water pails	1 75
70 ft. ⅝ hose	5 00

2 wheelbarrows	$5 [illegible]	
2 sledges	2 [illegible]	
2 8-in. bolted sleeves	5 [illegible]	
5 6-in. bolted sleeves	7 83	
22 4-in. bolted sleeves	25 41	
7 2-in. plain sleeves	3 15	
7 3-in. plain sleeves	4 15	
2 4-in. plain sleeves	1 91	
3 6-in. plain sleeves	3 66	
2 8-in. plain sleeves	2 [illegible]	
3 3-in. bends	2 22	
3 3-in. curves	1 73	
2 4-in. curves	2 57	
3 4-in. Flower's gate stems	5 25	
5 4-in. Mich. Brass & Iron Wks. Stems	7 [illegible]	
4 6-in. Mich. Brass & Iron Wks. Stems	6 [illegible]	
4 4-in. Murdock gate stems	7 [illegible]	
1 6-in. Murdock gate stem	2 [illegible]	
5 4-in. stuffing boxes, M. B.	3 75	
4 6-in. stuffing boxes, M. B.	3 [illegible]	
6 8-in. stuffing boxes, M. B.	4 [illegible]	
1 4-in. stuffing box, Murdock	45	
5 crowbars	4 [illegible]	
1 machine for raising gate boxes	3 [illegible]	
2 axes	1 [illegible]	
2 3-in. caps for iron pipe	[illegible]	
4 6-in. caps for iron pipe	1 [illegible]	
1 8-in. cap for iron pipe	73	
2 10-in. caps for iron pipe	1 [illegible]	
2 4-in. iron plugs	[illegible]	
2 6-in. iron plugs	[illegible]	
1 8-in. iron plug	[illegible]	
1 3-in. tee	1 35	
9 chairs	3 [illegible]	
1 5-gal. gasoline can	[illegible]	
1 2-gal. gasoline can	[illegible]	
		$[illegible]

SERVICE [illegible]

2 Smith tapping machines	$[illegible]
2 2x4 Smith sleeve and valves	[illegible]
3 3x4 Smith sleeve and valves	[illegible]
1 4x4 Smith sleeve and valve	[illegible]
1 2x6 Smith sleeve and valve	[illegible]
2 3x6 Smith sleeve and valves	[illegible]
1 4x6 Smith sleeve and valve	[illegible]

1 2x8 Smith sleeve and valve	$12 00	
1 3x8 Smith sleeve and valve	14 00	
1 4x8 Smith sleeve and valve	18 00	
1 2x10 Smith sleeve and valve	16 00	
1 3x10 Smith sleeve and valve	18 00	
1 4x10 Smith sleeve and valve	22 00	
3 Mueller tapping machines	255 00	
2 30-in. saddles	2 00	
2 24-in. saddles	2 00	
2 16-in. saddles	2 00	
3 12-in. saddles	3 00	
3 8-in. saddles	3 00	
3 6-in. saddles	3 00	
3 4-in. saddles	3 00	
3 3-in. saddles	3 00	
5 yokes	5 00	
3 pressure wrenches	1 50	
3 tap handles	50	
15 1-in. drills	60 00	
2 ¾-in. drills	5 00	
17 ⅝-in. drills	51 00	
2 ½-in. drills	3 50	
105 1-in. service cocks	50 40	
60 ⅝-in. service cocks	17 40	
5 oil cans	1 00	
2 leather jackets	4 00	
2 pair rubber boots	6 00	
1 Stilson wrench	12 00	
5 monkey wrenches	3 75	
1 emery wheel	2 00	
		$1,712 05

METER DEPARTMENT.

Meters placed and in use		$97,484 65
1 Barnes' foot lathe	$90 00	
1 counter shaft and pulleys	10 00	
1 Pelton water motor No. 2	50 00	
1 Cushman lathe chuck	4 00	
1 Acme drill chuck	3 00	
1 lathe plug for drill chuck	90	
1 lathe clamp	1 12	
1 set Armstrong tool holders "A.O."	3 25	
1 set Armstrong boring tool No. 8	3 25	
4 solid lathe tools	1 00	
1 thread chaser	25	
1 breast drill	1 75	
1 set of stocks and dies, ⅛ to 1-in	5 00	

1 set of stocks and dies, 1¼ to 2-in.	$ 7 00
1 set of ratchet dies, 1-in. to 2-in.	7 00
1 set No. 2½ Armstrong stocks and dies	7 50
1 set No. 2 Armstrong stocks and 1⅛ gas tap	2 80
1 2-in. pipe cutter, single wheel	1 25
1 1-in. pipe cutter, Barnes No. 1 3-wheel	2 00
1 2-in. pipe cutter, Barnes' No. 2 "	2 75
1 4-in. pipe cutter, Barnes' No. 4 "	8 00
1 6-in. pipe cutter, Barnes' No. 5 "	12 00
5 cutter wheels	1 25
1 14-in. frame wrench	1 75
3 12-in. monkey wrenches, at 75c	2 25
2 18-in. monkey wrenches, at $1.50	3 00
3 long screw drivers, at 50c	1 50
3 Crowfoot wrenches, at $1.00	3 00
3 solid wrenches, at 75c	2 25
3 Westcott wrenches, at $1.25	3 75
2 pair pipe tongs, at $1.00	2 00
2 pair chain tongs, Brock No. 3, at $5.50	11 00
1 nail puller	1 25
1 seal punch	4 00
4 6-in. ladles., at 50c	2 00
2 set calking tools	1 90
1 calking hammer	1 00
1 pipe vice combination	7 50
1 bench vise	6 00
1 hand vise	40
1 washer cutter	50
1 hollow punch	40
5 small shut-off keys	5 00
1 long shut-off key	2 00
1 large gate key	4 00
2 stop box augers	3 00
1 stop box shovel	50
3 dirt pounders	2 25
2 pair hip boots, at $3.00	6 00
1 1-gal. can, 40c; ½, 60c; 1-5, 75c	1 75
3 fire-pots (new), at $3.50	10 50
4 cross-cut saws, at $1.50	6 00
4 rip saws, at $1.50	6 00
3 hand-axes, at $1.00	3 00
1 jack plane	50
1 wood chisel	50
1 extension bit	1 70
1 saw set	75

1 try square	$	50
1 portable electric lamp	10	00
1 rope tackle	2	00
1 chain tackle	10	00
1 testing apparatus	30	00
7 pumps, at $2.00	14	00
4 bailing dippers	2	50
7 lanterns, at 30c	2	10
2 red lanterns, at 65c	1	30
9 combination wrenches, at $3.00	27	00
8 pair cover handles, at 40c	3	20
2 bicycles	50	00
Furniture and fixtures	100	00
517 gear wheels and shafts	56	15
18 diaphragms	8	20
276 meter flange bolts	16	17
11 meter discs and pistons	56	00
9 registers	10	00
16 gear frames	11	00
1053 gaskets	56	03
8 flanges	6	75
5 driver frames	2	85
7 disc chambers	7	35
192 bushings	7	49
144 reducers	11	39
70 unions	12	07
68 45° elbows	9	15
45 street elbows	5	92
46 elbows	3	44
136 nipples	7	47
65 couplings	3	54
29 tees	1	72
220 feet pipe	6	85
196 meter couplings	49	84
22 soldering nipples	1	44
8 stop cocks	4	50
92 lbs. lead pipe	3	68
66 lbs. wiping solder	5	28
13 lbs. ½ and ½ solder	1	56
10 lbs. tin	1	80
577 lbs. expansion joints	8	65
14 bolts for expansion joints	3	50
10 lbs. sleeves		15
10 2-in. nipples	1	50
6 3-in. nipples	1	92
2 4-in. nipples	1	00

1 6-in. nipple	$ 1 00	
1 4-in. gate	5 00	
8 Rouse checks	5 14	
3 lbs. hemp packing, at 12c	36	
5 lbs. rubber packing, at 15c	75	
1034 lbs. old covers	15 51	
2640 lbs. new covers	39 60	
1442 feet hemlock lumber	15 86	
57 feet pine lumber	1 14	
6 files, 14-in	1 80	
4 files 12-in	80	
1½ gallons graphite paint	1 50	
2 blankets and 2 covers	15 00	
Meters in stock	1,631 00	
		$2,705 39

IRON PIPE DEPARTMENT.

Pipe in Ground.

103	feet	45-in.	pipe	$ 1,699 50	
19,491	"	42-in.	"	825,366 34	
715	"	36-in.	"	6,587 35	
54,428	"	30-in.	"	255,495 60	
84,363	"	24-in.	"	401,448 87	
106	"	20-in.	"	519 30	
87	"	18-in.	"	278 40	
48,068	"	16-in.	"	150,022 28	
23,015	"	12-in.	"	43,208 56	
148,816	"	10-in.	"	219,771 64	
293,813	"	8-in.	"	334,750 92	
1,170,502	"	6-in.	"	840,453 35	
781,896	"	4-in.	"	490,697 02	
66,790	"	3-in.	"	33,150 42	
2,820	"	2-in.	"	752 10	
2,720,013 total feet.					$3,604,201 65

STOCK AT RESERVOIR.

Iron pipe	$ 27,789 38
Specials	5,691 81
Gates and valves	1,811 90
Gate boxes	107 88
Gate well covers	282 82
Lead	3,092 08
Packing	38 29
Oil	3 19
Coal	83 06
Scrap iron and brass	557 50

Tools	$ 3,449 92	
Tile, brick, cement, etc	408 92	
Office fixtures	60 00	
Covers and blankets	68 00	
Feed, etc	241 40	
Steam pump	400 00	
		$44,086 15

HORSES AND WAGONS.

1 horse, phaeton, cutter and harness—Office	$ 305 00	
1 horse, vehicles and harness—Pumping Works	230 00	
2 horses, 2 wagons and 2 sets of harness, 2 sets of runners—Meter	365 00	
6 horses, 6 wagons, 1 carriage and 6 sets of harness—Repairing Leaks	950 00	
2 horses, 2 wagons, 2 sets of harness—Service Connections	400 00	
8 buggies, 8 sets of harness, etc—Service Connections	800 00	
1 horse, cart and harness—Hurlbut Fund.	150 00	
12 horses, 16 sets of harness, 6 trucks, 7 wagons, 1 cart, 4 buggies, 4 sets of runners, 1 sleigh, 1 cutter—Iron Pipe Department	3,830 00	
		$7,030 00
Aggregate		$5,228,255 43

SUPPLEMENT.

BOARD OF MANAGEMENT OF DETROIT WATER WORKS.

Board of Trustees appointed by Common Council, February 24th, 1852; organized March 1st, 1852.

Shubael Conant, Chairman. **Edmund A. Brush.**
Henry Ledyard. **Wm. R. Noyes.**
Jas. A. Van Dyke.

1853.

On the 16th of May, 1853, the Board of Water Commissioners of the City of Detroit was organized under an act previously approved by the Common Council and passed by the Legislature, February 14th, 1853. The term of service was determined by lot, as follows:

Jas. A. Van Dyke,	**for 3 years.**
Edmund A. Brush,	**for 4 years.**
Henry Ledyard,	**for 5 years.**
Shubael Conant,	**for 6 years.**
Wm. R. Noyes,	**for 7 years.**

Shubael Conant was elected President, who, finding the duties too arduous, resigned July 30th, and Edmund A. Brush was elected.

1854.

Edmund A Brush, President. **Jas. A. Van Dyke.**
Shubael Conant. **Wm. R. Noyes.**
Henry Ledyard.

1855.

Edmund A. Brush, President.
Henry Ledyard.
Shubael Conant.
William R. Noyes.
James A. Van Dyke, died May 8th.
A. D. Fraser, appointed to fill vacancy.

1856.

Edmund A. Brush, President.
Shubael Conant.
William R. Noyes.
Alexander D. Fraser, re-appointed May 1st, for 5 years.
Henry Ledyard.

1857.

Edmund A. Brush, President, re-appointed May 1st, for 5 years.
Henry Ledyard.
Alexander D. Fraser.
William R. Noyes.
Shubael Conant.

1858.

Edmund A. Brush, President.
Shubael Conant.
Alexander D. Fraser.
Henry Ledyard, re-appointed May 1st, for 5 years.
William R. Noyes.

1859.

Edmund A. Brush, President.
Alexander D. Fraser.
William R. Noyes.
Shubael Conant, term expired May 1st, and
Julius D. Morton, appointed for 5 years.
Henry Ledyard, vacated by removal from city, and
John V. Ruehle, appointed May 1st to fill vacancy.

1860.

Edmund A. Brush, President.
Alexander D. Fraser.
Julius D. Morton.
William R. Noyes, re-appointed May 1st, for 5 years.
John V. Ruehle.

1861.

Edmund A. Brush, President.
Alexander D. Fraser, re-appointed May 1st, for 5 years.
Jno. V. Ruehle, resigned Sept. 16th, and
Chauncey Hurlbut, appointed to fill vacancy.

1862.

Edmund A. Brush, President, re-appointed May 1st, for 5 years.
Wm. R. Noyes.
Julius D. Morton.
Chauncey Hurlbut.
Alexander D. Fraser.

1863.

Edmund A. Brush, President.
Alexander D. Fraser.
Wm. R. Noyes.
Julius D. Morton.
Chauncey Hurlbut, term expired May 1st, and
Stanley G. Wight, appointed for 5 years.

1864.

Edmund A. Brush, President.
Alexander D. Fraser.
Wm. R. Noyes.
Julius D. Morton, term expired May 1st.
Stanley G. Wight.

1865.

Edmund A. Brush, President.
Wm. R. Noyes, resigned Jan. 10, and Jacob S. Farrand appointed to fill vacancy. Term expired May 1st. Reappointed for 5 years.
Alexander D. Fraser.
Stanley G. Wight.
Julius D. Morton, re-appointed for 5 years from May 1st, 1864. Died Feb. 14, 1865, and
Jno. Owen, appointed to fill vacancy.

1866.

Edmund A. Brush, President.
Alexander D. Fraser, re-appointed May 1, for 5 years.
Stanley G. Wight.
Jacob S. Farrand.
John Owen.

1867.

Edmund A. Brush, President, re-appointed May 1 for 5 years.
Alexander D. Fraser.
Jacob S. Farrand.
John Owen.
Stanley G. Wight.

1868.

*Edmund A. Brush, President.
Stanley G. Wight, term expired May 1, and
Chauncey Hurlbut, appointed for 5 years.
Jacob S. Farrand.
John Owen.
Caleb Van Husan.

*Edmund A. Brush resigned January 28, and Caleb Van Husan appointed to fill vacancy, and Alexander D. Fraser elected President.

1869.

Alex. D. Fraser, President.
John Owen, re-appointed May 1, for 5 years.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.

1870.

Alex. D. Fraser, President.
Jacob S. Farrand, re-appointed May 1, for 5 years.
John Owen.
Caleb Van Husan.
Chauncey Hurlbut.

1871.

*Alex. D. Fraser, President.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.
John Owen.

*Term expired May 1, and Samuel F. Hodge appointed for 5 years. Jacob S. Farrand elected President.

1872.

Jacob S. Farrand, President.
Jno. Owen.
*Caleb Van Husan.
Samuel F. Hodge.
Chauncey Hurlbut.

*Term expired May 1st, and Elija Smith appointed for 5 years.

1873.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed. Elected President, May, 1872.

1874.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1875.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1876.

Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. *Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1877.

Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
*Michael Martz.

*Elija Smith's term expired and Michael Martz appointed to fill vacancy.

1878.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Michael Martz.

*Term expired and re-appointed.

1879.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas Beatty.
*Jno. Pridgeon.

*Jno. Owen's term expired and Jno. Pridgeon appointed to fill vacancy. Samuel F. Hodge resigned and Jas. Beatty appointed to fill vacancy.

1880.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1881.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1882.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1883.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1884.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
*Jno. Pridgeon.

*Term expired; Marshall H. Godfrey appointed.

1885.

*Jacob S. Farrand, President.
Michael Martz.
Marshall H. Godfrey.
*Edwin F. Conely.
*Samuel G. Caskey.

*Jas. Beatty died and Edwin F. Conely appointed to fill vacancy.

*Chauncey Hurlbut died and Samuel G. Caskey appointed to fill vacancy.

*Jacob S. Farrand's term expired and re-appointed.

1886.

Jacob S. Farrand, President.
Michael Martz.
Marshall H. Godfrey.
*Jno. Pridgeon.
Samuel G. Caskey.

*Edwin F. Conely's term expired and Jno. Pridgeon appointed to fill vacancy.

1887.

Jacob S. Farrand, President.
Jno. Pridgeon.
Marshall H. Godfrey.
Samuel G. Caskey.
*Joseph Nagel.

*Michael Martz's term expired and Joseph Nagel appointed to fill vacancy.

1888.

Jacob S. Farrand, President.
Jno. Pridgeon.
Marshall H. Godfrey.
*Samuel G. Caskey.
Joseph Nagel.

*Term expired and re-appointed.

1889.

Jacob S. Farrand, President.
Jno. Pridgeon.
Samuel G. Caskey.
Jos. Nagel.
*August Goebel.

*Marshall H. Godfrey resigned January 1, 1889. August Goebel appointed to fill vacancy. Term expired May 1st, and re-appointed.

1890.

John Pridgeon, President.
August Goebel.
Joseph Nagel.
*Henry M. Duffield.
Samuel G. Caskey.

*Jacob S. Farrand's term expired, and Col. Duffield was appointed to fill vacancy July 9th, 1890; John Pridgeon resigned as President of the Board, on account of ill-health, and Henry M. Duffield was elected to fill vacancy.

1891.

Henry M. Duffield, President. ***John Pridgeon.**
August Goebel. Samuel G. Caskey.
Joseph L. Hudson.

*John Pridgeon's term expired May 1st, and Frank E. Kirby was appointed for a term of 5 years.

1892.

Samuel G. Caskey, President. Henry M. Duffield.
August Goebel. Joseph L. Hudson.
Frank E. Kirby.

1893.

August Goebel, President. Samuel G. Caskey.
Frank E. Kirby. Henry M. Duffield.
Joseph L. Hudson.

1894.

Henry M. Duffield, President. Frank E. Kirby.
Albert L. Stephens. DeWitt H. Moreland.
Edward W. Pendleton.

A. L. Stephens appointed to succeed J. L. Hudson.

D. W. H. Moreland appointed to succeed S. G. Caskey.

Clarence A. Black appointed to succeed August Goebel.

C. A. Black resigned and E. W. Pendleton appointed to succeed him from Dec. 1st.

1895.

Frank E. Kirby, President. Albert L. Stephens.
DeWitt H. Moreland. Edward W. Pendleton.
Darius D. Thorp.

1896.

Albert L. Stephens, President. John P. Huckestein.
Edward W. Pendleton. Darius D. Thorp.
John W. McGrath.

D. W. H. Moreland resigned to accept Commissionership on Board of Public Works, and J. P. Huckestein was appointed to fill vacancy.

Frank E. Kirby's term expired and J. W. McGrath was appointed to succeed him.

STREETS NEWLY OPENED

IN THE CITY LIMITS.

LOCATED BY WARDS AND PRECINCTS, JANUARY, 1897.

	Ward.	Precinct.
Adel St.—N. from Harper	9-11	7
Adele St.—St. Aubin to Chene	9-11	7
Amsterdam St.—Cass to Third	2-4	8
Annetta Ave.—N. from Caniff to N. City Line	3	8
Antoinette St.—Woodward to Third	2-4	8
Beach Place—from the River to Edgemere Boul	15	1
Beck St.—from Parkman to N. of Seward	4	8
Beneteau St.—N. from Jefferson E. of City Limits,	....	..
Berlin St.—from Elmwood to Boulevard	13-15	2-4
Bohemian Ave.—Cass to Third	2-4	8
Brock Place—S. from Pallister	6	8
Brown Place—W. from Twenty-Sixth	14	5
Burrell Place—E. from Maybury Ave	12	6
Cameron Ave.—N. from Holbrook to City Line	5	7
Campau St.—Dix to Toledo	14	2
Canfield Ave.—Lincoln to Grand River	8	7
Canton Ave.—N. from Harper	15	6
Carter Place—E. from Twelfth	8-6	8
Carrie St.—N. from Harper	15	6
Chippewa Ave.—Gratiot to Harper	15	6
Church St.—E. and W. of Eleventh	8	2
Colburn Ave.—Cass to Third	2-4	8
Concord Ave.—N. from Harper	15	6
Dexter St.—N. from N. Boulevard	12	6
Duncan St.—Morton to Newland	15	6
Dyar Ave.—N. from Holbrook	7	6
Eastern Place—W. from Twenty-Sixth	14	5
Edgemere Boulevard—E. and W. from Beach Place,	15	4
Elm St.—between Twelfth and Thirteenth	8	4-5
Ferry Ave.—Woodward to Third	2-4	7
Finley Ave.—W. from Jos. Campau	9-11	7
Fordyce Ave.—N. from Marston Ave.	9-11	7
Foster St—N. from Harper	15	6
Frank St.—Sixth to Seventh	6	6
G. A. R. St.—Welch to Hammond	16	5
Greenfield Ave.—S. from Pallister	6	8
Greusel St.—Otis to Michigan Ave.	16	4
Gilbert Place—Twelfth to Hamilton Boulevard	8-6	8
Goodwin St.—N. from Holbrook to City Line	3-5	8-7
Hazel St.—between Harrison and Grand River	8	6
Helen Ave.—Macomb to Mack	15	2
Holden Ave.—Cass to Third	2-4	8
Ida Ave.—E. from Scotten	16	2
Iroquois St.—N. from Jefferson	15	4
Island View Boulevard—S. from Jefferson	15	1

	Ward.	Precinct.
Ironside St.—Welch to Hammond	16	5
J. P. Ave.—Clark to Scotten	14	1
Knox St.—from Holbrook to Gilette	7	6
Lambert St.—Morton to Newland	15	5
Lamson Place—S. from Pallister	6	8
Lee Place—E. from Twelfth	8	8
Le May St.—N. from Jefferson E. of City Limits	....	..
Lyman St.—W. from Chene	9-11	7
Lodi St.—N. of Holburn Ave	13	5
Mansur St.—Harper to Piquette	5	7
Marshland Road—N. from Jefferson, E. of City Limits	....	..
Maxwell St.—N. from Jefferson	15	4
Merrill Place—S. from Pallister	6	8
Montclair St. N. from N Boulevard (bet. 18th and Grand River)	12	6
McBrearty Place—Rivard to Russell	5	7
Medbury Ave.—Morton to Newland	15	5
Montrose St.—W. from Hamilton Boulevard	6-8	8-8
Morrow St.—N. from Clay and Holbrook	9	7
Moore Place—W. from Twenty-Sixth	12	6
Morton Ave.—Gratiot to Harper	15	5
Nelson St.—between D., G. H. & M. R. R. & Dyar,	7	6
Newland St.—Mack to Harper	15	5
Newport Ave.—N. of Jefferson, E. of City Limits	....	..
Newton Ave.—W. from Jos. Campau	9-11	7
O'Flynn St.—N. of Jefferson, E. of City Limits	....	..
Otto St.—N. and S. from Seward	4	8
Park View Boulevard—S. from Jefferson	15	4
Parker St.—N. from Jefferson	15	4
Pollard Ave.—W. from Jos. Campau	9-11	7
Richard St.—Seyburn to Van Dyke	15	3
Rolf Place—N. from Mack	15	5
Saginaw St.—N. from Holburn Ave	13	5
Scovel Place—W. from Twenty-Sixth	12	6
Seneca St.—Gratiot to Harper	15	5
Seminole St.—N. from Jefferson	15	4
Scheffer Place—W. from Moran	13	5
Sherwood St.—N. from Harper	15	6
Sixth St.—Lysander to Forest	6	6
Spring St.—Clark to Scotten	14	1
Stevens Ave.—Gratiot to Harper	15	5
Stephens St.—Mack to Harper	15	5
St. Charles St.—Harper to Strong	15	6
St. Albertus Place—Dequindre to St. Aubin	9	6
St. Jean Road—N. from Jefferson, E. of City Limits	....	..
Sylvester St.—E. and W. from Van Dyke	15	6-5
Third Ave.—N. Boulevard to N. of Bethune	4	8
Thurman St.—Gratiot to Hendrie	15	5
Toledo St.—between Twenty-Fourth and Scotten	12-14	2-3
Twenty-Sixth St.—S. from Grand River	12	6
Vienna St.—Woodward to Third	2-4	8
Warsaw Place—E. from Dequindre	9	6
Welch Ave.—Ranspach to Michigan	16	4
Wilbur Ave.—E. from Lincoln	6	8
Wildemere St.—Welch to Hammond	12	6

Respectfully submitted,

HENRY BRIDGE,
Supt. Extensions.

PIPE CONSTRUCTION, 1896.

The following is a detailed list of the total lines laid, giving locations, size of pipe and length of same.

DATE.	LOCATION.	Diameter in Inches.							
		4	6	8	10	12	16	30	42
Sept. 18......	Alexandrine ave., w. line of Dubois to e. line of same................	.....	50	.....	......	......	.....	.....	.....
Dec. 12......	Alexandrine ave., 5 ft. w. of e. of alley e. of St. Antoine to 14 ft. e of w. of Rivard..	......	.....	......	......	......	......	1,253	.....
July 7......	Alfred st., w. line of Hastings to 21 ft. e. of w. of same..............	.....	.....	21	......	.....	.....	.....	.....
" 15......	Alfred st., 22 ft. w. of e. of St. Antoine to w. line of Hastings.........	.....	..	610	......	.....	......	.....	.....
May 4......	Alger ave., 100 ft. e. of e. of John R. to 2 ft. e. of e. of Brush.........	.....	631	......	......	......	......	......	......
Sept. 5......	Annexation st., 194 ft. w. of w. of Junction to 25 ft. w. of e. of same..	.....	235	.....	......	.....	......	......	.....
July 29......	Antietam st., 22 ft. w. of w. of McDougall to w. line of Elmwood.	......	354	.....	.....	.....	......	......	.....
Aug. 1......	Antietam st., crossing w. side of Elmwood	.....	15	.....	.....	......	......	.....	......
July 15......	Army ave., 4 ft. w. of w. of Military to 41 ft. e. of w. of same......	.....	45	......	.....	......	......	......	......
July 18......	Baker st., 18 ft. w. of e. of Seventh to 24 ft. e of w. of Sixth........	.....	398	......	......	.....	......	......	......
Jan. 2, '97..	Baker st., 25 ft. w. of e. of Cavalry to 27 ft. w. of e. of Campbell....	..	578	....	......	....	......	......	.....
May 9......	Belvidere ave., 22 ft. n. of s. of Gratiot to 226 ft. s. of s. of same....	......	248	.....	....	......	......	.....	......
Oct. 12......	Berlin st., 29 ft. e. of w. of Bellevue to 22 ft. e. of w. of Concord......	...	386	......	....	.....	......	.....	......
April 21......	Blaine ave., 22 ft. e. of w. of Hamilton Boulevard to 106 ft. e. of e. of Third..	......	......	1,042	......	.....	....	......	.....
June 26......	Bowen ave., crossing Jefferson..	......	74	....	......	......	.....	......	.....
Aug. 28......	Bowen ave., 100 ft. s. of s. of Kercheval to 40 ft. n. of same............	.....	220	....	.....	.....	.....	.....	.....
Jan. 5, '97..	Brady st., Rivard to Russell...........	.....	......	......	......	......	.....	413	.....
Sept. 15......	Brandon pl., 158 ft. w. of Moran to 112 ft. w. of same..................	......	146	......	.....	......	.....	......	....
Sept. 26......	Breckenridge st., alley s. of 178 ft. w. of w. of Humboldt to 25 ft. w of e. of same..	......	208	......	....	.....	.....	......	......
Dec. 4......	Brownlee pl., 25 ft. s. of n. of Stanley to 307 ft. n. of n. of same.......	.....	332	......	......	......	......	......	......
May 2......	Brush st., crossing Melbourne..........	......	..	61	....	.....	.....	......	.....
May 4......	Brush st., crossing Alger..	......	.....	60	.....	......	......	......	....
May 26......	Brush st., crossing King..	....	......	62	......	....	.....	.....	.....
Sept. 26......	Brush st., 21 ft. s. of n. of Watson to 15 ft. n. of n. of same..........	.....	......	.....	......	.....	44	......	......

Oct. 12	Brush st., 15 ft. n. of n. of Watson to 27 ft. s. of n. of Erskine						325		
Jan. 2, '97	Buena Vista ave. (Highland Park), 16 ft. w. of e. of Woodward to 2,296 ft. e. of e. of same		2,312						
Mar. 24	Canfield ave., alley s. 4 ft. w. of e. of alley e. of Russell to 6 ft. e of w. of alley w. of Riopelle	907							
Sept. 22	Cass ave., 47 ft. n. of s. of Pitcher to 25 ft. n. of s. of Stimson pl.					190			
Oct. 3	Cass ave., alley w. of 17 ft. s. of n. of Putnam to 30 ft. s. of n. of Merrick		409						
July 30	Catherine st., e. line of Jos. Campau to 18 ft. w. of e. of McDougall			570					
Aug. 15	Charlotte ave., 22 ft. e. of w. of Fifth to 29 ft. e. of w. of Fourth		311						
June 22	Chase st., 12 ft. w. of e. of Russell to 23 ft. e. of w. of Riopelle		505						
Sept. 3	Cherry st., 28 ft. w. of e. of National to 5 ft. e. of w. of Trumbull		570						
April 29	Collins st., alley e. of 8 ft. n. of s. of Scheffer pl. to 6 ft. s. of n. of alley s. of Ferry		98						
Aug. 26	Collins st., alley e. of 4 ft. n. of s. of alley n. of Forest to 11 ft. s. of n. of alley s. of Hancock		99						
April 21	Commonwealth ave., 242 ft. n. of n. of G. T. R. R. to 671 ft. s. of s. of Piquette		118						
Oct. 24	Concord ave., n. line of Mack to 27 ft. n. of s. of Sylvester		900						
Aug. 20	Congress st., crossing w. side of Canton		39						
Dec. 24	Cortland ave. (Highland Park), e. line of Hamilton Boulevard to 16 ft. w. of e. of Woodward		2,702						
Jan. 14	Dequindre st., 43 ft. n. of s. of N. Boulevard to 27 ft. n. of s. of Clay		1,376						
July 14	Division st., 26 ft. e. of w. of Hastings to 13 ft. e. of w. of Rivard			776					
Aug. 7	Division st., w. line of Rivard to 16 ft. e. of w. of same			16					
Sept. 18	Division st., 2 ft. n. of n. of Leland to 9 ft. n. of s. of Willis		786						
Oct. 5	Duffield st., 2 ft. e. of e. of Clifford to 29 ft. e. of w. of Woodward		926						
July 15	Dumontier st., 445 ft. e. of Crane to 331 ft. e. of same		114						
Aug. 21	Ellery st., crossing Ferry		47						
Aug. 1	Elmwood ave., 18 ft. s. of n. of Maple to s. line of Waterloo		1,093						
Oct. 12	Erskine st., 12 ft. w. of e. of Woodward to 14 ft. e. of w. of Brush						,311		
Nov. 10	Euclid ave., 1,036 ft. w. of w. of Woodward to 518 ft. w. of same		518						
May 26	Farnsworth ave., 39 ft. w. of e. of Moran to 401 ft. e. of same		440						
Dec. 23	Farrand ave. (Highland Park), 16 ft. w. of e. of Woodward to e. line of same		16						

PIPE CONSTRUCTION, 1896—CONTINUED.

DATE.	LOCATION.	DIAMETER IN INCHES.							
		4	6	8	10	12	16	30	42
Jan. 4, '97..	Farrand ave. (Highland Park), e. line of Woodward to 744 ft. e. of same		744						
July 2......	Ferdinand ave., 136 ft. n. of n. of Christiancy to 366 ft. s. of Dix......		435						
May 2.....	Ferry ave., 82 ft. e. of e. of Collins to 247 ft. w. of Moran...............		350						
Aug. 8......	Ferry ave., 28 ft. w. of e. of Mitchell to 58 ft. w. of Collins.............		702						
Aug. 21......	Ferry ave., 2 ft. w. of e. of Moran to 2 ft. e. of w. of Mt. Elliott....		1201						
April 29......	Ferry ave., alley s. of 8 ft. w. of e. of Collins to 6 ft. e. of w. of alley e. of Collins		180						
July 6......	Fourth ave., alley w. of 19 ft. s. of n. of Lysander to n. line same..	19							
Aug. 14......	Garfield ave., 239 ft. e. of e. of St. Antoine to 17 ft. e. of w. of Hastings,		361						
Jan. 8, '97..	Gerald ave. (Highland Park), 19 ft. w. of e. of Woodward to e. line of same		19						
Jan. 2, '97..	Gerald ave. (Highland Park), e. line of Woodward to w. line of Oakland		2637						
April 29......	Gladstone ave., 22 ft. e. of w. of Hamilton Boulevard to 805 ft. w. of Woodward		1885						
Jan. 4, '97.	Glendale ave. (Highland Park), 131 ft. e. of w. of Herman to 16 ft. w. of e. of Woodward		4001						
May 25......	Gratiot road (e. of city limits), Harper to French road			3000					
July 25......	Hale st., e. line of Chene to 17 ft. e. of w. of Grandy		563						
Jan. 5, '97..	Hale st., Riopelle to Orleans							409	
Dec. 24......	Hamilton Boulevard (Highland Park), 13 ft. s. of n. of Tuxedo to 55 ft. s. of n. of Elmhurst		233						
June 26......	Hammond ave., 124 ft. s. of s. of Julia to 20 ft. n. of n. of same......		144						
July 23......	Hancock ave., Seventeenth to alley e. of same		177						
Aug. 28......	Hancock ave., alley s. of 20 ft. w. of e. of Collins to 4 ft. w. of e. of alley e. of Collins		200						
Aug. 26......	Hancock ave., alley s. of 4 ft. w. of e. of alley e. of Collins to 25 ft. e. of w. of Moran		526						

July 3	**Harper ave.**, alley s. of 1 ft. e. of e. of Brush to 163 ft. e. of same		162						
Sept. 24	Harper ave., alley s. of at Brush		25						
July 7	**Hastings st.**, n. line of Division to 30 ft. s. of n. of Alfred			227					
July 14	Hastings st., 16 ft. s. of n. of Division to n. line of same			16					
Oct. 3	Hazel st., 29 ft. e. of w. of Wabash to 21 ft. e. of w. of Thirteenth		380						
June 17	Helen ave., 93 ft. s. of s. of Mathews to 4 ft. n. of s. of same		97						
July 25	High st., 23 ft. e. of w. of Rivard to 15 ft. e. of w. of Riopelle				925				
Dec. 17	Highland ave. (Highland Park), e. line of Hamilton Boulevard to 16 ft. w. of e. of Woodward		2,719						
May 2	Holbrook ave., 303 ft. e. of e. of Woodward to 17 ft. e. of w. of John R		297						
Aug. 29	Holcomb ave. 18 ft. n. of s. of Louis w. to 17 ft. s. of n. of Louis e.		99						
July 8	Howard st., e. line of Cavalry to 2 ft. e. of w. of Campbell		513						
Oct. 14	Howard st., 14 ft. w. of e. of Cavalry to e. line of same		14						
July 24	Hubbard Boulevard, 135 ft. s. of Warren to s. line of same		141						
Aug. 15	Hudson ave., 20 ft. e. of w. of Twenty-third to 34 ft. e. of w. of Maybury		1,130						
Aug. 19	Hunt st., 27 ft. w. of e. of Elmwood to 438 ft. e. of e. of same		465						
July 31	Jay st., 47 ft. w. of w. of McDougall to w. line of Elmwood		379						
Aug. 1	Jay st., crossing w. side of Elmwood		15						
July 14	Jean ave. 9 ft. e. of w. of Gratiot to 12 ft. e. of w. of alley e. of Pennsylvania	481							
May 30	Jefferson ave., at McClellan (replacing broken pipe)								13
Aug. 26	Jefferson ave. (s. side), 18 ft. w. of e. of St. Antoine to 18 ft. w. of e. of Orleans		2,793						
June 20	Jefferson ave. (n. side), 27 ft. e. of w. of Bellevue to 2 ft. e. of e. of Concord		432						
July 10	Jefferson ave (n. side), 2 ft. e. of e. of Concord to 46 ft. e. of w. of E. Boulevard		850						
July 10	Jefferson ave. (n. side), 46 ft. w. of e. of E. Boulevard to 26 ft. e. of w. Baldwin		1,397						
July 27	Jefferson ave. (n. side), 19 ft. w. of e. of Hastings to 28 ft. e. of w. of Orleans				2,160				
Aug. 19	**Jefferson ave.** (n. side), 529 ft. w. of w. of Leib to 26 ft. e. of w. of same		555						

PIPE CONSTRUCTION, 1896—CONTINUED.

DATE.	LOCATION.	DIAMETER IN INCHES.							
		4	6	8	10	12	16	30	42
Sept. 11	Jefferson ave (n. side), 13 ft. w. of e. of Leib to 11 ft. e. of w. of Meldrum			879					
Sept. 15	Jefferson ave. (n. side), 11 ft. e. of w. of Meldrum to 27 ft. e. of w. of Beaufait		419						
May 4	Jefferson ave., alley n. of 16 ft. e. of w. of Seyburn to 17 ft. w. of e. of same	40							
Aug. 7	Jefferson ave., alley n. of 27 ft. w. of e. of Van Dyke to e. line of same		27						
May 2	John R. st., crossing Melbourne		62						
May 2	John R. st., crossing Holbrook		43						
May 4	John R. st., 12 ft. n. of s. of Alger to 12 ft. s. of n. of same		36						
May 25	John R. st., crossing King		63						
Oct. 6	John R. st., 1 ft. n. of s. of Chandler to n. line of same		69						
Sept. 22	Joy st., 43 ft. w. of e. of Second to 32 ft. w. of e. of Cass			658					
June 25	Julia st., 11 ft. e. of w. of Hammond to 23 ft. e. of w. of Wesson		403						
June 30	Lafayette ave., 26 ft. w. of e. of McKinstry to 2 ft. e. of w. of Clark,		372						
Sept. 4	Larned st., 33 ft. w. of e. of Leib to 15 ft. w. of e. of same		18						
June 11	Leavitt ave., 25 ft. e. of w. of Wesson to 308 ft. e. of e. of same		349						
Sept. 4	Leib st., 8 ft. s. of n. of Jefferson to 24 ft. n. of s. of Congress			560					
Aug. 29	Louis ave., 28 ft. w. of e. of Holcomb to 83 ft. e. of e. of same		111						
July 6	Lysander ave., 40 ft. w. of e. of Lincoln to 19 ft. w. of e. of Fourth		1597						
July 30	McDougall ave., s. line of Catherine to 28 ft. n. of s. of same			28					
Aug. 6	McDougall ave., 35 ft. s. of n. of Clinton to s. line of Catherine			533					
Aug. 8	McDougall ave., crossing Ferry		49						
July 29	McDougall ave., alley e. of 85 ft. n. of n. of Chestnut to 23 ft. n. of s. of Antietam		160						
May 22	McMillan st., 25 ft. w. of e. of Livernois to 42 ft. e. of w. of Military		574						
Aug. 28	Mansur st., 78 ft. s. of s. of Piquette to 34 ft. s. of n. of same		124						
May 2	Melbourne ave., 18 ft. w. of e. of Woodward to 41 ft. e. of e. of Brush,			1424					

Feb. 28	Merrick ave., 20 ft. w. of e. of Twenty-fifth to 26 ft. e. of w. of Twenty-fourth		260						
Nov. 14	Milwaukee ave., 2 ft. w. of e. of McDougall Boulevard to 19 ft. w. of e. of Craig		188						
Sept. 24	Montcalm st., e. line of Park to 6 ft. w. of e. of alley e. of Woodward,		687						
Sept. 24	Montcalm st., 6 ft. e. of e. of Clifford to 2 ft. e. of w. of Park		356						
May 8	Montclair ave. (e. of city limits), 9 ft. s. of s. of Canfield to 596 ft. n. of n. of same		665						
April 11	Moore pl., 14 ft. e. of w. of Scotten to 4 ft. e. of w. of Hubbard Boulevard		420						
Oct. 9	Morrell st., 84 ft. n. of n. of Christiancy to 366 ft. s. of Dix		464						
Aug. 6	Mullett st., 5 ft. w. of w. of McDougall to e. line of same		85						
Sept. 11	Nall ave., e. line of Vinewood to 12 ft. e. of w. of Twenty-seventh		394						
May 20	Newland ave., 22 ft. n. of s. of Gratiot to s. line of Medbury		453						
Aug. 20	Norton st., 154 ft. e. of e. of alley e. of Wesson to 226 ft. e. of same		72						
Nov. 12	Norton st., 25 ft. e. of w. of Wesson to 162 ft. w of w of same		187						
June 17	Orleans st., 2 ft. s. of s. of Milwaukee to 26 ft. s. of n. of same		36						
July 27	Orleans st., 60 ft. s. of n. of Jefferson to 20 ft. s. of n. of same				40				
Jan. 2, '97	Orleans st., Scott to Hale		279						
Jan. 2, '97	Orleans st., Scott to Hale							301	
Sept. 22	Palmer ave., 22 ft. w. of e. of Beaubien to 178 ft. e. of same		200						
May 12	Park ave. (e. of city limits), 125 ft. n. of n. of Warren to 645 ft. s. of Shoemaker		1,081						
July 21	Park View ave., crossing s. side of Jefferson		49						
Oct. 12	Parsons st., 37 ft. w. of e. of Cass to 27 ft. e. of w. of Woodward			908					
Mar. 4	Pennsylvania ave., 414 ft. n. of Kercheval to 620 ft. n. of n. of same		206						
July 29	Pitcher st., 14 ft. e. of w. of Third to 12 ft. e. of e. of same				65				
Sept. 5	Pitcher st., 12 ft. e. of e. of Third to 42 ft. w. of e. of Second				616				
Sept. 22	Pitcher st., 42 ft. w. of e. of Second to 18 ft. w. of e. of Cass					677			
May 8	Porter st., 8 ft. e. of e. of Scotten to 21 ft. e. of e. of same	13							
May 8	Porter st., 21 ft. e. of e. of Scotten to 14 ft. w. of e. of Hubbard		598						
Mar. 12	Putnam ave., 22 ft. w. of e. of Sullivan to 221 ft. e. of same		244						
Oct. 3	Putnam ave., 4 ft. w. of e. of alley w. of Cass to 318 ft. w. of Cass		115						
July 15	Regular ave., 8 ft. w. of w. of Military to 41 ft. e. of w. of same		49						
May 5	Richard st., main in Seyburn to 6 ft. w. of e. of same		24						
June 17	Riopelle st., crossing Milwaukee		60						

PIPE CONSTRUCTION, 1896—CONTINUED.

DATE.	LOCATION.	DIAMETER IN INCHES. 4	6	8	10	12	16	30	42
June 19	Riopelle st., 150 ft. s. of s. of Warren to 2 ft. n. of n. of same		206						
July 21	Riopelle st., 4 ft. n. of n. of Warren to s. line of Farnsworth		520						
July 25	Riopelle st., 50 ft. s. of s. of High to 19 ft. n. of s. of same				69				
Jan. 5, '97	Riopelle st., Hale to Rowena							152	
Feb. 26	Riopelle st., alley w. of 21 ft. n. of s. of Canfield to 21 ft. n. of s. of Willis	388							
May 21	Rivard st., 125 ft. n. of Harper to 150 ft. s. of Piquette		87						
Aug. 7	Rivard st., 30 ft. n. of s. of High to 27 ft. s. of n. of Winder				514				
Aug. 7	Rivard st., 27 ft. s. of n. of Winder to 25 ft. n. of s. of Division			528					
Oct. 19	Rivard st., 142 ft. s. of s. of Piquette to 12 ft. n. of s. of same		154						
Jan. 5, '97	Rivard st., Brady to Alexandrine							1013	
Nov. 2	Rolfe pl., 522 ft. n. of n. of Mack to 770 ft. n. of same		248						
July 10	Rollin st., 193 ft. w. of Wesson to 24 ft. e. of w. of same		217						
Jan. 5, '97	Rowena st., Russell to Riopelle							494	
Jan. 5, '97	Russell st., Brady to Rowena							171	
Aug. 26	St. Antoine st., 4 ft. s. of s. of Hamlin to n. line of same		84						
Dec. 12	St. Antoine st., alley e. of 19 ft. s. of n. of Alexandrine to 27 ft. n. of s. of Canfield							902	
Dec. 12	St. Antoine st., alley e. of 18 ft. s. of n. of Superior to 18 ft. s. of n. of Willis		282						
Mar. 24	St. Aubin ave., alley w. of 24 ft. n. of s. of Hancock to 6 ft. s. of n. of alley n. of Hancock	142							
June 18	St. Paul ave., 28 ft. e. of w. of Baldwin to 3 ft. e. of e. of same		40						
April 29	Scheffer pl., 6 ft. e. of w. of alley e. of Collins to 21 ft. e. of w. of Moran		532						
Jan. 2, '97	Scott st., e. of Orleans							66	
April 11	Scotten ave., 245 ft. s. of s. of Moore pl. to 14 ft. s. of n. of same		291						
July 15	Sears ave., 193 ft. e. of McClellan to 255 ft. e. of same		62						
June 16	Second ave., s. line of Bethune to 1 ft. s. of n. of same		59						

Aug. 26	Second ave., 3 ft. s. of s. of Hazelwood to 1 ft. s. of n. of same		63						
July 29	Selden ave., 7 ft. w. of w. of Third to 16 ft. e. of w. of Third			23					
Sept. 12	Selden ave., 4 ft. w. of e. of alley e. of Trumbull to 20 ft. e. of w. of Third			2,042					
Sept. 17	Selden ave., 43 ft. w. of e. of Second to 38 ft. w. of e. of Cass		653						
July 29	Seyburn ave., 585 ft. s. of s. of Gratiot to 462 ft. s. of s. of same		123						
Sept. 30	Sibley st., e. line of Clifford to 28 ft. e. of w. of Woodward		965						
July 21	Sixth st., 112 ft. s. of s. of Forest to 27 ft. n. of s. of same		139						
May 22	Stanley ave., 21 ft. w. of e. of Williams to Maybury			347					
Sept. 22	Stimson pl., 18 ft. w. of e. of Cass to 29 ft. e. of w. of Woodward					930			
Oct. 12	Stimson pl., 29 ft. e. of w. of Woodward to 7 ft. w. of e. of same						38		
Mar. 4	Sullivan ave., 463 ft. n. of n. of Buchanan to 11 ft. s. of s. of D. & B. C. R. R		245						
Mar. 12	Sullivan ave., 14 ft. s. of n. of Putnam to 24 ft. s. of n. of Merrick		293						
April 3	Sullivan ave., 25 ft. n. of s. of Baltimore to 25 ft. s. of n. of Milwaukee		366						
Sept. 19	Sullivan ave., 36 ft. e. of w. of Grand River to 24 ft. s. of n. of Stanley		465						
Sept. 18	Superior st., w. line of Dubois to e. line of same		50						
Oct. 24	Sylvester st., 23 ft. e. of w. of Concord to 32 ft. e. of w. of same		9						
July 6	Theodore st., 193 ft. e. of e. of Helen to 229 e. of same		36						
July 21	Theodore st., w. to e. line of Riopelle		48						
April 21	Third ave., crossing Blaine		44						
June 12	Third ave., s. line of Bethune to 1 ft. s. of n. of same		59						
July 29	Third ave., 48 ft. n. of s. of Pitcher to 21 ft. s. of n. of Selden				1,028				
Oct. 5	Thirteenth st., 20 ft. s. of n. of Hazel to 34 ft. s. of n. of Linden		266						
May 21	Thirty-fourth st., 136 ft. n. of Jackson to 4 ft. s. of s. of Buchanan		760						
Sept. 14	Toledo ave., 19 ft. e. of w. of Hubbard to w. line of Vinewood		401						
Sept. 3	Trumbull ave., alley w. of 32 ft. s. of n. of Cherry to 20 ft. s. of n. of same		12						
Dec. 24	Tuxedo ave. (Highland Park), 13 ft. w. of e. of Hamilton Boulevard to 14 ft. e. of w. of Woodward		2,647						
Jan. 2, '97	Tuxedo ave. (Highland Park), 14 ft. e. of w. of Woodward to 16 ft. w. of e. of same		71						
Aug. 15	Twenty-third st., 1 ft. s. of s. of Hudson to 1 ft. n. of n. of same		62						
Feb. 28	Twenty-fifth st., 190 ft. s. of s. of Merrick to 30 ft. n. of s. of same		218						

PIPE CONSTRUCTION, 1896—CONTINUED.

DATE.	LOCATION.	Diameter in Inches.							
		4	6	8	10	12	16	30	42
Nov. 25	Twenty-eighth st., 14 ft. n. of n. of Rich to 125 ft. n. of same		111						
Aug. 19	Walnut st., 325 ft. w. of w. of Van Dyke to 263 ft. w. of same		62						
Mar. 24	Warren ave., alley s. of 10 ft. e. of w. of Warren Court to 6 ft e. of w. of alley w. of St. Aubin	78							
Mar. 24	Warren Court, 6 ft. n. of s. of alley n. of Hancock to 60 ft. n. of same	71							
Oct. 24	Wesson ave., 190 ft. n. of n. of Herbert to 263 ft. n. of same		73						
July 2	West Boulevard, bet. Michigan and Myrtle		48						
Nov. 21	West End ave. (w. of city limits), 24 ft. n. of s. of River road to 172 ft. n. of n. of Frederick	876							
May 13	Williams ave., 25 ft. n. of s. of Hudson to 26 ft. s. of n. of Stanley		509						
July 1	Winder st., 30 ft. w. of e. of Hastings to w. line of Rivard		769						
Oct. 12	Woodward ave. (e. side), 27 ft. s. of n. of Erskine to 25 ft. n. of s. of Stimson pl						320		
Jan. 4, '97	Woodward ave. (Highland Park), 16 ft. n. of city limits to 45 ft. n. of same		36						
Dec. 29	Woodward ave. (Highland Park), 45 ft. n. of city limits to 14 ft. s. of n. of Monterey						815		
Jan. 14, '97	Woodward ave. (Highland Park), 14 ft. s. of n. of Monterey to n. line of Gerald					4200			
Jan. 14, '97	Woodward ave. (Highland Park), n. line of Gerald to n. line of Moss.				3457				

PIPEAGE OF THE CITY OF DETROIT,

JANUARY, 1897.

ALPHABETED BY STREETS, SHOWING THE SIZE OF IRON PIPE IN USE.

LOCATION.	DIAM. INCHES.
A st., e. from Scotten 78 ft	4
" Hubbard to Vinewood	4
Aberle ave., e. from Russell 349 ft.	4
Abbott st., Tenth to Cass	24
" w. from Third 20 ft	6
" alley s. of, crossing Sixth	6
" alley s. of, 196 ft. e. of Twelfth to Cass	4
Adair st., the river to 10 ft. n. of s. of Jefferson	6
" 10 ft. n. of s. to 29 ft. n. of s. of Jefferson	4
Adams ave., John R. to Randolph	6
" Witherell to Hastings	4
" alley s. of, Cass to 240 ft. e. of Clifford	4
" alley s. of John R. to Randolph	4
Adelaide st., 30 ft. e. of w. of Woodward to 22 ft. e. of w. of Brush.	8
" 22 ft. e. of w. of Brush to 24 ft. e. of w. of Beaubien	10
" 24 ft. e. of w. of Beaubien to Orleans	4
" Orleans to 11 ft. e. of e. of same	18
" 11 ft. e. of e. of Orleans to Gratiot	10
" crossing Gratiot	8
Adele st., 23 ft. w. of e. of Chene to 8 ft. w. cf w. of same	6
Agnes ave., e. Boulevard to Field	4
" Baldwin to Seyburn	6
" 21 ft. w. of e. of Seminole to 20 ft. w. of e. of Iroquois	8
Albert st., Hammond to Wesson	6
Alexandrine ave., Grand River ave. main to alley w. of Commonwealth	6
" alley w. of Commonwealth to alley w. of Trumbull	4
" alley w. of Trumbull to Seventh	6
" Seventh to Sixth	4
" Greenwood to 150 ft. w. of Fourth	4
" 150 ft. w. of Fourth to Fourth	3
" Third to Cass	4
" Cass to Woodward	6
" Woodward to John R.	4
" John R. to 143 ft. w. of Brush (center of st.)	6
" 143 ft. w. of, to 28 ft. w. of e. of Brush e. (s. lawn),	6
" 143 ft. w. of Brush to Beaubien	4
" Beaubien to 15 ft. w. of w. of St. Antoine	3
" 15 ft. w. of w. of St. Antoine to 20 ft. w. of e. of same	4
" 20 ft. w. of e. of St. Antoine to Russell	6

LOCATION.	DIAM. INCHES.
Alexandrine ave., 5 ft. w. of e. of alley e. of St. Antoine to 14 ft. e. of w. of Rivard	30
" Russell to alley w. of Dubois	4
" alley w. of Dubois to w. line of Dubois	3
" w. line of Dubois to e. line of same	6
" e. line of Dubois to w. line of Chene	3
" w. line of Chene to w. line of Grandy	4
" crossing Grandy	3
" McDougall to alley e. of same	6
" alley e. of McDougall to 367 ft. e. of e. Moran	4
Alfred st., 30 ft. e. of w. of Woodward to 16 ft. w. of e. of John R.,	8
" 16 ft. w. of e. of John R. to e. line of Brush	6
" e. line of Brush to 22 ft. w. of e. of St. Antoine	4
" 22 ft. w. of e. of St. Antoine to 21 ft. e. of w. of Hastings,	8
" 21 ft. e. of w. of Hastings to Russell	4
" Russell to Orleans	3
" Orleans to Dubois	4
Alger ave., 16 ft. Main to e. line of Woodward	6
" e. line of Woodward to 514 ft. e. of same	4
" 514 ft. e. of Woodward to 2 ft. e. of e. of Brush	6
" Russell to 443 ft. e. of Greeley	6
Amherst st., 23 ft. e. of w. of Cavalry to 314 ft. w. of Junction	6
" 314 ft. w. of w. to Junction	4
Amsterdam st., 44 ft. w. of e. of Second to 44 ft. w. of w. of Cass..	6
" 44 ft. w. of w. to e. line of Cass	4
" e. line of Cass to w. line of Woodward	6
" crossing Woodward, w. side	4
Annexation st., 194 ft. w. of w. of, to 25 ft. w. of e. of Junction	6
" 25 ft. w. of e. of Junction to 540 ft. e. of e. of same..	4
Anthon st., 260 ft. w. of Campbell to 360 ft. w. of Junction	6
" 360 ft. w. of w. of Junction to 30 ft. w. of e. of same	4
Antietam st., Rivard to Jos. Campau	4
" crossing Jos. Campau	6
" Jos. Campau to 22 ft. w. of w. of McDougall	4
" 22 ft. w. of w. of McDougall to 15 ft. e. of w. of Elmwood	6
Antoinette st., crossing e. half of Eighteenth	4
" e. line of Eighteenth to 28 ft. e. of w. of Stanton	6
" Fifteenth to 223 ft. w. of Fourteenth	6
" 223 ft. w. of, to Fourteenth	4
" Fourteenth to 138 ft. w. of Wabash	6
" 138 ft. w. of, to Wabash	4
" 193 ft. w. of, to Twelfth	4
" 43 ft. w. of e. to e. line of Second	4
" e. line of Second to Cass	6
Arlington pl., Cass to Woodward	4
Army ave., 4 ft. w. of w. of Military to 41 ft. e. of w. of same	6
Arndt st., Gratiot to 6 ft. w. of w. of Elmwood	6
" 6 ft. w. of w. of Elmwood to Mt. Elliott	4
Artillery ave., n. from River st. to Battery	6
" crossing Fort	6
" 78 ft. s. of s. to n. line of Lafayette	6
" 477 ft. s. of s. of to main in Dix	8
Ash st., Vinewood to Twenty-seventh	4
" Twenty-fourth to e. line of Tillman	4
" Maybury to 250 ft. e. of e. of same	4
" 250 ft. e. of e. of Maybury to Sullivan	3
" Sullivan to Humboldt	4

LOCATION.	DIAM. INCHES.
Ast st., Humboldt to 166 ft. e. of e. of same	3
“ 166 ft. e. of e. of Humboldt to e. line of Eighteenth	4
“ e. line of Eighteenth to w. line of Seventeenth	3
“ w. line of Seventeenth to e. line of Sixteenth	4
“ crossing Fifteenth	4
“ 148 ft. w. of w. to Wabash	4
“ alley e. of Wabash to Twelfth	6
“ Twelfth to Harrison	4
“ National to alley w. of Trumbull	6
“ alley e. of Trumbull to Grand River	4
Atkinson ave., 16 in. main to 21 ft. w. of Woodward	6
Atwater st., Shelby to 8 ft. w. of w. of Brush	6
“ 8 ft. w. of w. of Brush to 149 ft. e. of e. of Rivard	4
“ 149 ft. e. of e. of Rivard to 33 ft. w. of e. of McDougall,	6
“ alley s. of, alley w. of Bates to Randolph	4
Audrain st. (in line of), Clippert to Michigan Brass & Iron Works 1,808 ft. (outside of city limits)	4
Aurelia st., w. line of Thirteenth to Twelfth	4
Avery ave., 21 ft. n. of s. of Willis to 345 ft. n. of Kirby	6
“ s. from Piquette 104 ft	6
“ alley w. of, Alexandrine to alley s. of Willis	4
“ alley w. of, Lysander to Lombard Terrace	6
B. st., 313 ft. w. of to Vinewood	4
Bagg st., Fifteenth to Woodward	24
“ crossing e. half of Greenwood	4
“ e. line of Greenwood to Fifth	3
Bagley ave., Grand River to Park	8
“ alley e. of Cass to alley s. of Park	4
Baker st., 25 ft. w. of e. of Cavalry to 27 ft. w. of e. of Campbell,	6
“ Scotten to Hubbard	4
“ crossing e. side of Vinewood	6
“ Vinewood to Twenty-fifth	4
“ crossing e. side of Twenty-fifth	6
“ Twenty-fifth to Twenty-fourth	4
“ Twenty-fourth and Seventh	8
“ 125 ft. e. of e. of Eighth to Seventh	4
“ 18 ft. w. of e. of Seventh to 24 ft. e. of w. of Sixth	6
“ alley s. of, Fourteenth to Wabash	4
“ alley s. of Tenth to Eighth	3
“ alley s. of, Eighth to alley w. of Fourth	4
Baldwin ave., Jefferson to Waterloo	6
“ Mack, s. 267 ft	6
“ Mack to Gratiot	10
“ Gratiot to Harper	8
Baltimore ave., 297 ft. w. of to Sullivan	4
“ Lincoln to w. line of Greenwood	6
“ Greenwood to Woodward	4
“ Woodward to w. line of Brush	8
“ crossing w. side of Brush 41 ft	6
“ alley s. of, Greenwood to Forsyth	6
Bancroft ave., 16 in. main to w. line of Woodward	6
Bates st., Atwater to Farmer	6
“ Congress to Champlain	30
“ alley e. of, n. line Atwater to alley s. of Woodbridge	3
Battery st., Artillery to Dragoon	6
Beacon st., crossing e. side of Brush	6
“ Brush to 211 ft. e. of St. Antoine	4

LOCATION.	DIAM. INCHES.
Beals ave., 1,628 ft. s. of to Mack	6
Beaman st., alley w. of to Crane	4
Beaubien st., Atwater to s. line Champlain	6
" s. line Champlain to 4 ft. s. of n. of alley n. of	8
" alley n. of Champlain to Clinton	6
" Clinton to s. line of Gratiot	4
" crossing s. side of Gratiot	6
" Gratiot to 14 ft. s. of n. of Madison	8
" Madison to 23 ft. s. of n. of Elizabeth	4
" 31 ft. s. of n. of Elizabeth to 28 ft. n of s. of Columbia	12
" 28 ft. n. of s. of Columbia to 16 ft. n. of s. of Adelaide,	10
" crossing n. side of Adelaide	6
" n. line of Adelaide to Watson	4
" Watson to Harper	10
" Harper to s. line of Boulevard	6
" crossing s. side of Boulevard	10
" 47 ft. s. of n. of Boulevard to Custer	6
Beaufait ave., Jefferson n. 585 ft	6
" 585 ft. n. of Jefferson to 225 ft. s. of Champlain	4
" 225 ft. s. of Champlain to 263 ft. n. of Kercheval	6
" s. line of Mack to 190 ft. n. of n. of Forest	6
" crossing n. Boulevard	6
Beaver st., Vinewood to Twenty-seventh	4
Beech st., Seventh to First	4
Bellevue ave., Jefferson to 281 ft. n. of n. of Stuart	6
" crossing Gratiot	6
" Gratiot to 25 ft. s. of s. of Frederick	4
" 25 ft. s. of s. of Frederick to 100 ft. n. of n. of same	6
" crossing n. Boulevard	8
Belmont ave., 16 in. main to e. line of Woodward	6
" 99 ft. w. of w. of to Oakland	6
Belvidere ave., crossing n. side of Jefferson	10
" n. line of Jefferson to 285 ft. n. of same	6
" 30 ft. s. of n. of St. Paul to 535 ft. n. of Lorman	6
" crossing s. side of Mack to 177 ft. s. of same	6
" 226 ft. s. of s. of Gratiot to 22 ft. n. of s. of same	6
Benton st., Brush to 8 ft. w. of e. of Beaubien	8
" Beaubien to Russell	4
Berlin st., Gratiot to Jos. Campau	3
" crossing Jos. Campau	4
" Jos. Campau to alley w. of McDougall	6
" alley e. of McDougall to Elmwood	3
" crossing to Elmwood	4
" Ellery to Mt. Elliott	4
" 29 ft. e. of w. of Bellevue to 22 ft. e. of w. of Concord	6
Bethune ave., Hamilton Boulevard to Woodward	6
Biddle st., Vinewood to Twenty-seventh	4
Blaine ave., 22 ft. e. of w. of Hamilton Boulevard to 106 ft. e. of e. of Third	8
" 106 ft. e. of e. of Third to w. line of Woodward	4
" w. line of Woodward to 16 in. main	6
Boone st., e. Boulevard to 81 ft. e. of e. of same	6
" 314 ft. w. of Collins to w. line of same	4
" 11 ft. e. of e. of Collins to 284 ft. w. of w. of Moran	6
" 284 ft. w. of to Moran	4
Boulevard, between Fort and Myrtle, see **W. Boulevard.**	
" between Twenty-seventh and Hubbard, see **Myrtle Boulevard.**	

LOCATION.	DIAM. INCHES.
Boulevard, between Myrtle and N. Boulevard, see Hubbard Boulevard.	
" between Hubbard Boulevard and McDougall, see N. Boulevard.	
" between n. Boulevard and Hendrie, see McDougall Boulevard.	
" between McDougall and Frontenac, see Hendrie Boulevard.	
" between Hendrie and Jefferson, see Frontenac Boulevard.	
Bowen ave., Jefferson to 40 ft. n. of Kercheval	6
Bradley st., 211 ft. w. of to Crane	4
Brady st., Woodward to 3 ft. w. of w. of Brush	6
" 3 ft. w. of w. of Brush to 18 ft. w. of e. of Beaubien	8
" Beaubien to Russell	4
" Rivard to Russell	30
Brainard st., Trumbull to e. line of Seventh	6
" e. line of Seventh to Sixth	4
" Greenwood to alley w. of Fourth	3
" alley w. of, to 16 ft. w. of e. of Fourth	4
" 16 ft. w. of e. of Fourth to 17 ft. e. of w. of Third	6
" Third to Cass	4
Brandon pl., 258 ft. w. of to Moran	6
Brandon ave. (west), Campbell to Junction	6
" Junction to Hubbard	4
Bratshaw st., 15 ft. w. of e. of Fourth to 28 ft. e. of w. of Third	10
Breckenridge st., 74 ft. w. of to Humboldt	4
" Humboldt to Eighteenth	6
" Eighteenth to 148 ft. w. of Sixteenth	4
" 148 ft. w. of to Sixteenth	6
" Fifteenth to 140 ft. w. of Fourteenth	6
" 140 ft. w. of, to Fourteenth	4
" alley s. of 178 ft. w. of w. of Humboldt to 25 ft. w. of e. of same	6
Brevoort pl., Twenty-second to alley e. of	6
" Nineteenth to alley w. of Eighteenth	4
Brewster st., crossing e. side of Brush	6
" e. line of Brush to Russell	4
" Riopelle to Gratiot	4
Brinket st., Crane to Hibbard	6
Bristol pl., Twenty-second to Twenty-first	4
Brownlee pl., 25 ft. s. of n. of Stanley to 307 ft. n. of n. of same	6
Brown pl., 25 ft. w. of e. of Twenty sixth e. 145 ft.	6
Bruce st., 2 ft. w. of alley w. of to Crane	4
Brush st., Atwater to Jefferson	6
" crossing Jefferson	8
" Jefferson to Congress	4
" Congress to Gratiot	8
" Gratiot to 28 ft. n. of s. of Madison	4
" Madison to 10 ft. s. of n. of Elizabeth	8
" Elizabeth to s. line of Adelaide	4
" crossing s. side of Adelaide	6
" 15 ft. n. of s. of Adelaide to 21 ft. s. of n. of Edmund	10
" Edmund to Watson	24
" 21 ft. s. of n. of Watson to 27 ft. s. of n. of Erskine	16
" Watson to Benton	6
" 15 ft. n. of s. of Benton to 28 ft. s. of n. of Rowena	8
" Brady to 3 ft. n. of s. of Alexandrine	8
" 2 ft. n. of s. of Alexandrine to 230 ft. n. of Milwaukee	6
" 230 ft. n. of Milwaukee to 24 in. main in n. Boulevard	8

LOCATION.	DIAM. INCHES
Brush st., crossing Palmer, both sides	4
" Horton to Hamlin	4
" crossing Chandler	6
" crossing Melbourne	8
" crossing Alger	8
" crossing King	8
Bryant st., e from Wabash 125 ft	6
" 125 ft. e. of Wabash to Twelfth	4
Buchanan st., Livernois to Vinewood	16
" Vinewood to Grand River	30
" Twenty-eighth to Scotten	4
" Twenty fourth to Twenty-third	4
" Williams to e. line of Maybury	4
" e. line of Maybury to 75 ft. e of Sullivan	3
" 387 ft. w. of Humboldt to Eighteenth	4
" 169 ft. w. of, to Seventeenth	4
" Fifteenth to Wabash	4
" alley s. of Joe to Howell	6
Buena Vista ave. (Highland Park), 16 ft. w. of e. of Woodward to 2,296 ft. e. of e. of same	6
Burns ave., Jefferson from 42 in. main n. 435 ft	10
" 42 in. main in Champlain to n. line of St. Paul	12
Burlage pl., Waterloo to Cleveland	8
Burlingame ave., Woodward 16 in. main to 1,264 ft. w. of same	6
Burrell pl., 26 ft. w. of e. of Maybury to 213 ft. e. of Sullivan	6
Bushey st., Michigan to 21 ft. n. of s. of Julia	6
Butternut st., Twenty-fourth to Fifteenth	24
" Williams to 227 ft. e. of Maybury	4
" e. from Seventeenth 141 f .	4
" e. from Wabash 263 ft	4
" National to alley w. of Trumbull	4
" alley e. of Trumbull to Seventh	4
C. st., Hubbard to Vinewood	4
Cadillac ave., pumping works to Mack	42
" crossing Jefferson to n. line	6
" 1,000 ft. n. of to 2,050 ft. n. of Jefferson	6
" 95 ft. s. of to Harper	6
Cadillac Square, s. side, Woodward to Randolph	24
" n. side, Monroe to Bates	6
" alley n. of from second alley e. of Woodward to Randolph	4
" alley s. of, alley e. of Woodward to Bates	4
Cadillac Park, 283 ft. w. from Bates to 120 ft. e. of same	4
Calumet ave., w. line of Twelfth to 196 ft. e. of same	4
" crossing Lincoln	4
" Eighth to Fourth	4
" Grand River to Third	30
Calvert ave., crossing Woodward to w. line	6
Cameron ave., 24 in. main to 132 ft. n. of N. Boulevard	6
" 132 ft. n. of N. Boulevard to Clay	4
" Clay to 23 ft. n. of Koch	6
" 26 ft. s. of n. of Haigh to 99 ft. n. of n	6
Campau st., River st. to Fort	6
" n. from Dix 448 ft	4
Campbell ave., River st. to Dunn	6
" Michigan to 161 ft. n. of Herbert	6
Canfield ave., Thirteenth to 48 ft. e. of same	4

	LOCATION.	DIAM. INCHES.
Canfield ave.,	48 ft. e. of Thirteenth to Twelfth	3
"	crossing Seventh	4
"	e. line of Seventh to Sixth	3
"	Greenwood to Fourth	4
"	Third to Woodward	4
"	Third to Woodward	30
"	Woodward to Collins	42
"	Woodward to 767 ft. w. of Mt. Elliott	6
"	767 ft. w. of, to Mt. Elliott	4
"	Canton to 9 ft. w. of Helen	6
"	alley s. of, from Hastings to alley e. of same	3
"	alley s. of 4 ft. w. of e. of alley e. of Russell to 6 ft. e. of w. of alley w. of Riopelle	4
Caniff ave.,	16 in. main to w. line of Woodward	6
"	w. of w. line of Woodward 27 ft.	4
Canton ave.,	Jefferson to 210 ft. n. of Kercheval	6
"	crossing Mack	6
"	23 ft. s. of n. of Stuart to Gratiot	6
"	Hancock to 168 ft. n. of Frederick	6
"	Medbury to Piquette	6
"	crossing N. Boulevard	6
Caroline st.,	Thirteenth to 192 ft. w. of Twelfth	6
"	192 ft. w. of, to Twelfth	3 and 4
Cass st.,	Woodbridge to Jefferson	8
"	Jefferson to Fort	24
"	alley n. of Michigan to Spencer	4
"	alley w. of, from Spencer to Jones	4
"	Jefferson to Columbia	10
Cass ave.,	Columbia to Gilman	16
"	Gilman to Joy	10
"	25 ft. n. of s. of Stimson to 47 ft. n. of s. of Pitcher	12
"	Joy to Alexandrine	8
"	Alexandrine to 16 ft. s. of s. line of Canfield	6
"	crossing Canfield 48 ft	8
"	32 ft. n. of s. of Canfield to 19 ft. n. of n. of Warren	6
"	19 ft. n. of Warren to 34 ft. n. of s of Kirby (east)	10
"	Kirby (east) to Kirby (west)	12
"	21 ft. n. of s. of Kirby (west) to 20 ft. n. of s. of Holden	10
"	20 ft. n. of s. of Holden to 118 ft. s. of D. & B. C. R. R.	6
"	118 ft. s. of D. & B. C. R. R. to Milwaukee	8
"	s. line of N. Boulevard to 24 in. main	8
"	w. side crossing Forest and Putnam	4
"	alley w. of alley s. of Elizabeth to 119 ft. s. of Gilman	4
"	alley w. of 119 ft. s. of to Gilman	3
"	alley w. of Ledyard to Bagg	4
"	alley w. of 17 ft. s. of n. of Putnam to 30 ft. s. of n. of Merrick	6
Catherine st.,	Gratiot to Hastings	12
"	Hastings to Rivard	4
"	crossing Rivard	6
"	Rivard to w. line of Dequindre	4
"	w. line of Dequindre to e. line of St. Aubin	6
"	crossing Jos. Campau	6 and 8
"	e. line of St. Aubin to e. line of Jos. Campau	4
"	e. line of Jos. Campau to 18 ft. w. of e. of McDougall	8
"	McDougall to Elmwood	4

LOCATION.	DIAM. INCHES.
Cavalry ave., 36 ft. s. of n. of Fort to 18 ft. n. of s. of Celeron	6
" Lafayette to Amherst	6
" Regular to n. line of Dix	6
" n. line of Dix to Toledo	4
Celeron st., 274 ft. w. of Campbell to Junction	4
" 19 ft. w. of e. of Cavalry to 281 ft. e. of same	6
Celia st., Wabash to 4 ft. e. of e. line of same	4
" 4 ft. e. of e. of Wabash to Thirteenth	3
" Thirteenth to Twelfth	4
Champlain st., Randolph to St. Aubin	30
" Randolph to alley e. of same	4
" St. Antoine to Orleans	4
" Orleans to Elmwood	6
" Elmwood to 250 ft. w. of Leib	4
" 250 ft. w. of to Leib	3
" 30-in. main in Chene st. to Iroquois	42
" (in line of) from Iroquois through private property to intersection of Crane and Jefferson	42
" alley s. of, alley e. of Randolph to St. Antoine	4
Chandler ave., Woodward to Oakland	6
Charles st., Seventh to Sixth	4
Charlevoix st., Chene to e. line of Jos. Campau	4
" e. line of Jos. Campau to alley w. of McDougall	3
" alley e. of McDougall to Elmwood	4
" Ellery to Mt. Elliott	4
" 142 ft. w. of, to Concord	4
Charlotte ave., 22 ft. e. of w. of Fifth to 29 ft. e. of w. of Fourth	6
" alley e. of Third to Woodward	4
Chase st., (Delray) 6-in. main in River st. s. 477 ft	4
" 12 ft. w. of e. of Russell to 23 ft. e. of w. of Riopelle	6
Chene st., Atwater to s. line of N. Boulevard	6
" Congress to Canfield	30
Cherry st., Twelfth to Harrison	4
" 28 ft. w. of e. of National to 5 ft. e. of w. of Trumbull	6
" 5 ft. e. of w. of Trumbull to Seventh	4
" Seventh to Grand River	16
Chestnut st., Russell to Elmwood	4
" crossing Jos. Campau	6
Chipman st., Nineteenth to alley w. of Eighteenth	4
Chicago Boulevard, crossing Woodward from 16-in. main to e. line	6
Chope pl., Twenty-fourth to 167 ft. w. of Grand River	6
" 167 ft. w. of, to Grand River	4
Christiancy st., Morrell to Ferdinand	6
" Ferdinand to 122 ft. e. of e. of same	4
" 122 ft. e. of e. of Ferdinand to Lansing	6
" Lansing to 134 ft. e. of e. of same	4
" 134 ft. e. of e. of Lansing to McKinstry	6
Church st., 178 ft. w. of Eleventh to 78 ft. w. of Tenth	6
" 78 ft. w. of Tenth to e. line of same	4
" alley s. of Tenth to Eighth	4
Claremont ave., 175 ft. w. of, to Hamilton Boulevard	6
" 1,275 ft. w. of w. of Woodward to w. line of same	4
" w. line to 16-in. main in Woodward	6
Clark ave., River st. to s. line M. C. R. R.	8
" s. line M. C. R. R. to Michigan	6
" Michigan Peninsular Car Works to Michigan	4
" 20 ft. n. of s. of Rich (east) to 25 ft. n. of s. of Rich (west) 78 ft	6

LOCATION.	DIAM. INCHES.
Clark Park, 292 ft. w. of, to Scotten	4
" e. from Clark 282 ft	4
" n. and s. from 4-in. pipe 607 ft.	3
Clay ave., 16-in. main to 8 in. main in Woodward	8
" Woodward to Oakland	8
" Oakland to 393 ft. e. of St. Aubin	6
Cleveland st., St. Aubin to Elmwood	10
" Elmwood to Burlage pl	8
Cleveland pl., crossing Greenwood e. side	4
" e. from Greenwood 264 ft.	3
Clifford st., Sproat to Park pl	4
" alley w. of Griswold to e. line of Washington	4
" Washington to Woodward	12
Clinton st., Gratiot to Rivard	10
" Rivard to Orleans	16
" Orleans to Elmwood	8
" alley s. of, alley w. of Brush to St. Antoine	4
Clippert st., n. from Dennis 481 ft. (outside of city limits)	4
Coe ave., Van Dyke to Parker	6
Colby ave., crossing Russell e side	4
Collins st., Gratiot to Canfield	42
" Canfield to N. Boulevard	30
" Leland to Canfield	4
" n. from Canfield 563 ft	3
" 563 ft. n. of Canfield to 26 ft. n. of Hancock	4
" s. from Harper 150 ft	6
" alley e. of, 4 ft. n. of s. of alley n. of Forest to 11 ft. s. of n. of alley s. of Hancock	6
" alley e. of, 8 ft. n. of s. of Scheffer pl. to 6 ft. s. of n. of alley s. of Ferry	6
Columbia st., Cass to Park	16
" Park to Woodward	4
" Woodward to Rivard	6
" alley s. of, Cass to Woodward	6
Columbus ave., s. from Fort 570 ft	3
" crossing Fort	4
Commonwealth ave., crossing Grand River	6
" (west side), Alexandrine to Calumet	6
" crossing Forest 42 ft	12
" (both sides) crossing Hancock n. to s. line	6
" s. line of Putnam to Merrick	6
" s. line of Kirby to 7 ft. n. of Stanley	6
" 242 ft. n. of n. of G. T. R'y to Holden	6
Concord ave., Jefferson to s. line of Harper	6
Conger st., 21 ft. e. of w. of Baldwin to 27 ft. w. of e. of Van Dyke,	6
Congress st., Sixth to Bates	30
" Randolph to St. Aubin	24
" St. Aubin to Meldrum	42
" Bates to Brush	4
" St. Antoine to Mt. Elliott e. line	4
" crossing w. side of Canton	6
" 171 ft. w. of to Helen	4
" e. side Frontenac Boulevard to Field	4
" alley s. of, Seventh to Sixth	4
" alley s. of, Fourth to 250 ft. e. of same	4
" alley s. of, Third to Griswold	4
" alley s. of, 80 ft. w. of Brush to St. Antoine	4

LOCATION.	DIAM. INCHES.
Cook st., e. from Welch 289 ft	4
" 289 ft. e. of Welch to Hammond	6
Cortland ave. (Highland Park), e. line of Hamilton Boulevard to 16 ft. w. of e. of Woodward	6
Cracow pl., alley e. of, Hastings to Rivard	6
Craig ave., n. from Trombly 378 ft	3
" 378 ft. n. of Trombly to Milwaukee	6
Crane ave., Jefferson to Mack	8
Crary st., 211 ft. w. of, to Crane	4
Crystal st., Trombly to Milwaukee	4
Custer ave., e. from Woodward 298 ft	4
" 298 ft. e. of Woodward to John R.	6
" John R. to 307 ft. e. of same	4
" 307 ft. e. of John R. to Brush	6
" Brush to Hastings	4
" Rivard to 126 ft. e. of same	4
" 126 ft. e. of Rivard to Russell	6
Cutler st., e. from McClellan 480 ft	4
D. st., 300 ft. w. of, to Vinewood	4
Dalzelle st., Twenty-fourth to Twenty-third	4
" Twenty-third to Twenty-second	6
" Twenty-second to Foundry	4
" Thirteenth to Twelfth	3
" crossing Twelfth	4
Dane st., crossing Collins, e. side	6
" e. line of Collins to 338 ft. e. of Moran	4
" crossing Mt. Elliott from w. to e. line	6
Davenport st., Cass to Woodward	4
Davis pl., Theodore to alley s. of same	4
Delaware ave., 300 ft. w. of w. line of Second to 44 ft. w. of e. line of Woodward	6
Deming st., e. from Scotten 368 ft	4
Dennis st., Clippert to Livernois (outside city limits)	4
Dequindre st., Woodbridge to Jefferson	6
" w. side Jay to Waterloo	4
" e. side Waterloo to Gratiot	4
" s. from Adelaide 206 ft	4
" Alfred to Pierce	4
" Canfield to Willis	4
" 43 ft. n. of s. of N. Boulevard to 27 ft. n. of s. of Clay,	6
" alley e. of, s. from Ferry 266 ft	4
Dettloff court, crossing Hancock n. side	4
" Hancock to 270 ft. n. of n. of same	3
Devereaux st., Thirty-first to Thirtieth	6
Dillon ave., n. from Holden 687 ft	6
Division st., crossing e. side Brush	6
" e. line of Brush to 26 ft. e of w. of Hastings	4
" 26 ft. e. of w. of Hastings to Rivard	8
" Rivard to St. Aubin	4
Dix ave., Artillery to Twenty-fourth	10
" (n. side) crossing W. Boulevard 130 ft	6
" crossing Twenty-third	6
Dragoon ave., n. from River st. 563 ft	6
" Hussar to n. line of Dix	6
Driggs ave., Campbell crossing w. side	6
" Campbell to Junction	4
Dry Dock st., Swain to Lady's lane	4

LOCATION.	DIAM. INCHES.
Dubois st., Atwater to Clinton	6
" Clinton to Hunt	8
" Hunt to 9 ft. n. of s. of Willis	6
" 9 ft. n. of s. of Willis to s. line of Canfield	3
" Canfield crossing s. side 40 ft.	6
" Dubois st., 40 ft. n. of s. of Canfield to 25 ft. n. of s. of Farnsworth	16
" Farnsworth from 16-in. main to n. line 48 ft	8
" n. line of Farnsworth to 188 ft. n. of Frederick	4
" 188 ft. n. of Frederick to Ferry	6
" Ferry to Hendrie	4
" Hendrie to 100 ft. s. of Medbury	6
" 100 ft. s. of Medbury to 20 ft. s. of Harper	4
" 20 ft. s. of Harper to 22 ft. n. of s. of Trombly	8
" crossing N. Boulevard	8
Duffield st., Cass to 2 ft. e. of e. of Clifford	4
" 2 ft. e. of e. of Clifford to 29 ft. e. of w. of Woodward,	6
Dumontier st., e. from Crane 297 ft	4
" 297 ft. e. of to 445 ft. e. of Crane	6
Dunn st., Wesson to Campbell	3
Durand st., 29 ft. w. of e. of Van Dyke to 372 ft. w. of w. of same,	6
E. st., Hubbard to Vinewood	4
" crossing W. Boulevard from 5 ft. e. of w. to 2 ft. w. of e.,	6
" e. line of W. Boulevard to Twenty-sixth	4
" Twenty-sixth to Twenty-fifth	6
Eastern pl., 25 ft. w. of e. of Twenty-sixth e. 176 ft	6
Edison ave., 16-in. main in Woodward to w. line of same	6
Edmund pl., Woodward to Brush	24
Eighth st., 28 ft. s. of n. of River st. to 30 ft. n. of s. of Michigan,	8
" 30 ft. n. of s. of Michigan to 3 ft. n. of n. of Orchard	6
" 3 ft. n. of n. of Orchard to Cherry	4
" Grand River to Calumet	8
" crossing s. side of Calumet 40 ft	6
" Calumet to Lysander	4
Eighteenth st., Fort to s. line of Myrtle	6
" s. to n. line of Myrtle	8
" Myrtle to 50 ft. n. of Linden	6
" 50 ft. n. of to 370 ft. n. of Linden	3
" 370 ft. n. of to 468 ft. n. of Linden	4
" 468 ft. n. of Linden to n. line of Buchanan	6
" n. line of Buchanan to s. line of Hancock	4
" crossing s. side of Hancock	6
" Grand River to N. Boulevard (s. line)	6
" crossing N. Boulevard	8
" n. from N. Boulevard 228 ft	6
" alley w. of, Brevoort to Webster pl	4
" alley w. of, St, Clair to Wing pl	4
" alley w. of, Chipman to Johnson	4
Eighteenth-and-a-half st., 1,677 ft. s. of River st. s. 160 ft	4
" s. from River st. 677 ft	3
" River st. to Fort	4
Eleventh st., Leverette to Michigan	6
Eliot st., Woodward to 29 ft. w. of e. of John R	6
" John R. to Riopelle	4
Ellery st., Waterloo to Charlevoix	6
" Arndt to Berlin	6
" Heidelberg to Schneider pl	6

LOCATION.	DIAM. INCHES.
Ellery st., s. line of Mack to Gratiot	6
" crossing Ferry	6
" crossing Hendrie Boulevard	6
Ellery pl., Forest to Hancock	3
Elizabeth st., Grand River to Cass	8
" 22 ft. e. of w. of Park to 20 ft. e. of w. of Brush	8
" Brush to Beaubien	4
" (both sides) alley e. of Woodward to 177 ft. w. of Brush.	4
" Beaubien to St. Antoine	12
" St. Antoine to Hastings	4
" alley s. of, 100 ft. w. of Cass to Woodward	4
" alley s. of, alley e. of Woodward to Witherell	3
" alley s. of, John R. to Randolph	4
Elm st., alley e. of, Wabash to Harrison	4
" Harrison to National	6
" National to alley w. of Trumbull	4
" alley e. of Trumbull to Seventh	4
Elmwood ave., crossing Jefferson	6
" n. line of Jefferson to Monroe	4
" Monroe to Waterloo	6
" Waterloo to Hunt	4
" Hunt to Gratiot	6
Emmons st., McClellan to Pennsylvania	4
Endicott ave., crossing e. side of Woodward	4
" crossing w. side of John R.	6
Englewood ave., crossing Woodward e side	6
" e. line of Woodward to w. line of Oakland	4
" e. from w. line of Oakland 30 ft	6
Erie pl., crossing w. side of Moran 23 ft	6
Erskine st., 12 ft. w. of e. of Woodward to 14 ft. e. of w. of Brush,	16
" 14 ft. e. of w. of Brush to Russell	4
" Russell to 159 ft. w. of Riopelle	6
" 159 ft. w. of, to Riopelle	4
" Dequindre to w. line of Chene	4
" w. line of Chene to Grandy	8
Euclid ave., 1,036 ft. w. of, to Woodward	6
Exposition grounds, s. from River st. 948 ft	4
F. st., 140 ft. w. of, to Vinewood	4
" crossing roadway of Vinewood 27 ft	6
Fairbanks st., e. from Scoten 364 ft	4
Farmer st., Bates to Gratiot	6
" 15 ft. s. of to 38 ft. n. of 30-in. main in Gratiot	8
Farnsworth ave., Woodward to Rivard	6
" Rivard to Dubois	16
" crossing e. side of Dubois	6
" e. line of Dubois to Grandy	4
" Mitchell to McDougall	4
" crossing Collins	6
" Collins to Moran	3 and 4
" 39 ft. w. of e. of Moran to 401 ft. e. of e. of same,	6
" crossing Mt. Elliott from w. line to 14 ft. w. of e. 51 ft	6
" 162 ft. w. of Concord	6
" Canton to Helen	4
" crossing Frontenac Boulevard	6
" alley s. of, or first st. s of. crossing w. side of Moran	6

LOCATION.	DIAM. INCHES.
Farrand st., e. from McClellan 513 ft	6
Farrand ave. (Highland Park), 16 ft. w. of e. of Woodward to 744 ft. e. of e. of same	6
Ferdinand st., n. from River st. 975 ft	4
" 975 ft. n. of River st. to 493 ft. s. of s. of Fort	6
" 493 ft. s. of s. of to Fort	4
" Porter to 309 ft. n. of Dix	6
Ferry ave., Woodward to Russell	4
" Russell to St. Aubin	8
" St. Aubin to Mitchell	4
" 28 ft. w. of e. of Mitchell to w. line of Collins	6
" w. line of Collins to 82 ft. e. of e. of same	8
" 82 ft. e. of e. of Collins to 247 ft. w. of w. of Moran	6
" 247 ft. w. of to Moran	4
" Moran to 4-in. main in Mt. Elliott	6
" 24 ft. e. of w. of Helen to 222 ft. e. of e. of same	6
" crossing Frontenac Boulevard	8
" Townsend to Baldwin	6
" alley s. of, 168 ft. w. of to Secor pl	4
" alley s. of, 8 ft. w. of e. of Collins to 6 ft. e. of w. of alley e. of Collins	6
" alley n. of, 20 ft. e. of w. of Hastings e. 408 ft	6
Field ave., Jefferson to 740 ft. n. of Waterloo	6
" 4 ft. s. of Mack to 177 ft. n. of Medbury	6
Fifth st., Congress to alley n. of	8
" alley s. of, to alley n. of Lafayette	4
" Abbott to Cherry	6
" Cherry to Noble	4
" both sides of Elton and Crawford Parks	4
" Holden to 144 ft. s. of Piquette	4
" 144 ft. s. of to Piquette	6
Fifteenth st., Fort to n. line of Grand River	6
" Bagg to Buchanan	24
" n. from Warren 348 ft	6
" Kirby to Harper	6
" crossing N. Boulevard	6
Finley st., 433 ft. w. of to Jos. Campau	4
First st., Front to Woodbridge	6
" Woodbridge to alley n. of Jefferson	8
" Jefferson to s. line of Congress	4
" crossing Congress	8
" n. line of Congress to Fort	4
" Fort to Grand River	6
" alley w. of, alley s. of to Spencer	4
Fischer ave., Jefferson to 90 ft. n. of Beaman	6
" crossing Mack from 42-in. main to 8-in. main	8
" n. from Mack 1,483 ft	6
Fletcher st., w. from Wesson ave. 233 ft	4
Florence st., Harper to Piquette	4
Florene st., Shipherd to Van Dyke	6
Flower st., crossing Forest s. to n. line	4
" n. from Forest 260 ft	8
" 260 ft. n. of Forest to Hancock	6
Forest ave., Fourteenth to alley w. of Wabash	6
" 2 ft. w. of w. of Wabash to 190 ft. w. of Twelfth	6
" 190 ft. w. of Twelfth to Avery	4
" Avery to Commonwealth	6

	LOCATION.	DIAM. INCHES.
Forest ave.,	Commonwealth to Trumbull	8
"	crossing Trumbull	4
"	Lincoln to Seventh	6
"	Seventh to Fourth	4
"	(both sides) Third to Cass	4
"	Cass to 373 ft. w. of Rivard	4
"	373 ft. w. of to Rivard	6
"	Russell to w. line of Dubois	4
"	crossing Dubois from w. to e.	6
"	e. line of Dubois to 190 ft. w. of Grandy	4
"	190 ft. w. of Grandy to e. line of same	6
"	McDougall to e. line of Collins	6
"	e. line of Collins to Moran	4
"	Moran to 157 ft. w. of Beaufait	6
"	157 ft. w. of to Beaufait	4
"	e. from Baldwin 164 ft	4
"	alley s. of St. Antoine to 374 ft. w. of Hastings	6
"	alley s. of 374 ft. w. of to Hastings	4
Forsyth ave.,	Baltimore to alley s. of same	6
Fort st.,	w. line of Artillery to Twenty-fourth	8
"	Twenty-fourth to Hoffman	6
"	Hoffman to Fourteenth	8
"	Fourteenth to Tenth	6
"	20 ft. w. of e. of Tenth to 21 ft. w. of e. of Seventh	12
"	Seventh to Woodward	16
"	Griswold to Woodward	4
"	St. Antoine to Meldrum	4
"	168 ft. w. of to Helen	4
"	alley s. of, Eighth to Seventh	4
"	alley s. of, Seventh to Fifth	8
"	alley s. of, 10 f. w. of Third to Cass	4
"	alley s. of, Cass to Shelby	6
"	alley s. of, Shelby to 16 ft. w. of e. line of Griswold	4
"	alley s. of, 16 ft. w. of e. line of Griswold to alley w. of Woodward	8
"	alley s. of, w. line of Brush to St. Antoine	4
Foundry st.,	Baker to Michigan	6
Fourth st.,	Woodbridge to Larned	4
"	Larned to Congress	8
"	Fort to Grand River	6
"	alley w. of Labrosse to alley s. of Michigan	4
Fourth ave.,	Grand River to Bagg	4
"	Bagg to Calumet	6
"	Calumet to s. line of Kirby	4
"	s. to n. line of Kirby	6
"	n. line of Kirby to 21 ft. s. of n. of Bratshaw	4
"	21 ft. s. of n. of Bratshaw to 13 ft. s. of n. of Holden,	10
"	alley w. of, Brainard to alley n. of	4
"	alley w. of, Selden to alley s. of same	4
"	alley w. of, 19 ft. s. of n. of Lysander to n. line of same	4
"	alley w. of, n. line of Lysander to Prentiss	3
Fourteenth ave.,	Fort to Lafayette	8
"	Lafayette to Bagg	10
"	Bagg to Grand River	8
"	Grand River to s. line of N. Boulevard	6
"	s. to n. line of N. Boulevard	8

LOCATION.	DIAM. INCHES.
Fourteenth ave., (w. side) n. from Porter 402 ft	4
Fox st., Frank to Alexandrine	3 and 4
Frank st., Seventh to 23 ft. e. of w. of Sixth	6
" Sixth to Fourth	4
Franklin st., Randolph to Beaubien	4
" Beaubien to Orleans	6
" Orleans to 25 ft. e. of Dequindre	4
" 25 ft. e. of Dequindre to McDougall	6
" Walker to Adair	4
" 325 ft. w. of to Leib	4
" alley s. of, McDougall to Walker	4
Frederick ave., Woodward to 124 ft. e. of Riopelle	4
" 124 ft. e. of Riopelle to 139 ft. e. of same	6
" 252 ft. w. of St. Aubin to Jos. Campau	4
" Collins to 126 ft. e. of Moran	6
" 30 ft. w. of e. of Bellevue to 22 ft. e. of w. of Concord.	6
" Helen to 69 ft. w. of w. of Frontenac Boulevard	4
" connecting two mains in Mt. Elliott ave	6
Fremont pl., Collins to 443 ft. w. of Moran	6
" 443 ft. w. of to Moran	4
Front st., Third to 107 ft. e. of same	6
" Second to 170 ft. e. of First	4
Frontenac Boulevard (w. side), s. from 42-in. main in Jefferson to Belle Isle Park	10
" (w. side), crossing Jefferson ave. from main to n. line	6
" (w. side) main in Mack to n. line	4
" (w. side), s. line of Gratiot to n. side Hendrie Boulevard	6
" (w. side), crossing Farnsworth, Ferry and Hendrie	8
" (e. side), 424 ft. s. of to 220 ft s. of Jefferson.	3
" (e. side), 220 ft. s. of Jefferson to 30 ft. s. of " n. of St. Paul	6
" (e. side), 30 ft. s. of n. of St. Paul to s. line of Waterloo	4
" (e. side) s. line of Waterloo to 42-in. main in Mack	6
" (e. side), s. of Mack crossing Boulevard 76 ft.,	6
" (e. side), 4-in. pipe to 18 ft. n. of n. line of Mack	4
" (e. side), 42-in. main in Mack to 27 ft. n. of s. line of Gratiot	10
" (e. side), n. of 6-in. main from Gratiot n 53 ft.	6
" (e. side), crossing Farnsworth ave. and Hendrie Boulevard	6
" crossing Frontenac Boulevard s. of Jefferson 424 ft. s. of and 220 ft. s. of	3
Frontenac ave., s. from Medbury 93 ft	6
Galster st., Canfield to Forest	6
Garfield ave., Woodward to 367 ft. e. of e. of John R	4
" 367 ft. e. of e. of John R. to 10 ft. w. of Brush	6
" 10 ft. w. of Brush to e. line of Brush	4
" e. line of Brush to 222 ft. w. of Beaubien	6
" 222 ft. w. of Beaubien to e. line of St. Antoine	4
" e. line of St. Antoine to Hastings	6
" Hastings to w. line of Dubois	4

LOCATION.	DIAM. INCHES.
Garfield ave., crossing Dubois w. to e. line	6
“ e. line of Dubois to w. line of Chene	4
“ w. line of Chene to e. line of Grandy	6
“ e. from McDougall 218 ft	4
“ crossing Collins	6
“ 188 ft. w. of Galster to 213 ft. w. of Moran	6
“ 213 ft. w. of to Moran	4
“ crossing Moran e. side	6
“ crossing Mt. Elliott 53 ft	6
“ 182 ft. w. of to Beaufait	4
“ alley s. of, St. Antoine to 374 ft. w. of Hastings	6
“ alley s. of, 374 ft. w. of, to Hastings	4
“ alley s. of, Hastings to 335 ft. e. of same	8
Gerald ave. (Highland Park), 19 ft. w. of e. of Woodward to w. line of Oakland	6
Gillette ave., Greeley to 366 ft. e. of same	6
Gilman st., Grand River to Cass	16
Gladstone ave., 22 ft. e. of w. of Hamil on Boulevard to 16-in. main in Woodward	6
Glendale ave. (Highland Park), 131 ft. e. of w. of Herman to 16 ft. w. of e. of Woodward	6
Glynn court, 300 ft. w. of, to w. line of Woodward	4
“ w. line of Woodward to 16-in. main	6
Goethe st., Crane to Holcomb	4
“ e. from McClellan 228 ft	4
Goldner ave., Michigan to G. T. R. R	6
Grand River ave. Woodward to Cass	8
“ Cass to Third	6
“ Third to 400 ft. w. of Humboldt	8
“ 400 ft. w. of Humboldt to Vinewood	6
“ Vinewood to N. Boulevard	10
“ N. Boulevard to city limits	6
“ Calumet to Buchanan	30
“ connecting 30-in. with 8-in. in Buchanan 22 ft	8
“ (s. side) Second 56 ft. e. of Cherry	4
“ (n. side) e. from Eighth 110 ft	8
“ alley n. of, 10 ft. w. of Bagley to alley w. of Bagley,	4
“ alley n. of, Fourth to Union	4
“ alley n. of, w. from Lincoln 47 ft	4
“ alley n. of, Trumbull to alley w. of same	6
“ alley n. of, Wabash to alley w. of same	6
Grandy ave., Gratiot to Pierce	8
“ Pierce to Harper	6
“ n. from Harper 322 ft	4
“ 322 ft. n. of Harper to Chene	6
Granger st., e. from Baldwin 259 ft	6
“ 259 ft. e. of Baldwin to Van Dyke	4
Grant ct., n. from Warren 313 ft	4
Grant st., Thirteenth to Twelfth w. line	8
“ crossing w. side of Twelfth	4
Granville pl., Wabash to e. line of same	4
“ e. line of Wabash to Thirteenth	3
Gratiot ave.. Woodward to Raynor	30
“ Raynor to w. line of Rivard (s.)	10
“ w. line of Rivard (s.) to St. Aubin	12
“ Woodward to Brush	10
“ Brush to 64 ft. w. of Sheridan	6

LOCATION.	DIAM. INCHES.
Gratiot ave., 64 ft. w. of Sheridan to 266 ft. w. of Harper	8
" 266 ft. w. of Harper to Cadillac	6
" alley s. of, alley e. of Woodward to Farmer	4
" alley s. of, Farmer to alley e. of Farrar	6
Gratiot road, Harper to French road (east of city limits)	8
Greeley ave., Alger to Gillette	6
Greenwood ave., Bagg to Calumet	6
" crossing Calumet	8
" n. line of Calumet to N. Boulevard	6
Griffin st., see N. Boulevard.	
Griswold st., Detroit river to Atwater	3
" Atwater to State	6
" 25 ft. n. of n. of Grand River to 16 ft. s. of s. of Clifford	8
" 16 ft. s. of s. line of Clifford to 12-in. main in Clifford,	10
Grummond ave., Hamilton Boulevard to 16-in. main in Woodward	6
Guilloz st., Clay to Sidney	6
Guoin st., Russell to Riopelle	4
" Orleans to McDougall	10
" McDougall to Walker	6
Haigh ave., 16-in. main to e. line of Woodward	6
" e. line of Woodward to 158 ft. e. of same	4
" 158 ft. e. of Woodward to 668 ft. e of e. of same	6
" 22 ft. w. of e. of Cameron to 365 ft. e. of Greeley	6
Hale st., Riopelle to Orleans	30
" Riopelle to St. Aubin	6
" e. of St. Aubin 275 ft	4
" 275 ft. e. of St. Aubin to Dubois	3
" Dubois to Chene	4
" Chene to Jos. Campau	6
Hamilton ave., Mack to 3 ft. s. of s. of Warren	6
Hamilton Boulevard, crossing N. Boulevard	10
" n. line of N. Boulevard to 26 ft. s. of s. line of Blaine	4
" 26 ft. s. of s. of Blaine to Bancroft	10
" (Highland Park), 13 ft. s. of n. of Tuxedo to 55 ft. s. of n. of Elmhurst	6
Hamlin ave., Woodward to Oakland	4
Hammond ave., Toledo to s. line of L. S. & M. S. R. R	6
" 356 ft. s. of Leavitt to 175 ft. n. of Ranspach	6
" 124 ft. s. of s. of Julia to 20 ft. n. of s. of same	6
" Poplar to Horatio	6
Hancock ave., Scotten to Lasalle	4
" crossing Hubbard Boulevard 165 ft	6
" w. line of Vinewood to Twenty-sixth	4
" Twenty-fifth to e. line of Twenty-fourth	4
" Twenty-third to 155 ft. e. of e. line of same	4
" 155 ft. e. of e. of Twenty-third to 20 ft. w. of e. of Williams	6
" Eighteenth to Seventeenth	4
" Seventeenth to alley e. of	6
" crossing Fourteenth	4
" Fourteenth to w. line of Wabash	3
" w. line of Wabash to 130 ft. w. of Thirteenth	6
" 130 ft. w. of Thirteenth to Avery	4
" Avery to Commonwealth	6
" Commonwealth to Fourth	4

LOCATION.	DIAM. INCHES.
Hancock ave., s. side e. from Third 10 ft	4
" crossing Third	6
" n. side e. from Third 4 1 ft	4
" n. side 461 ft. e. of Third to Second	6
" w. line of Cass to 112 ft. e. of Riopelle	4
" 488 ft. w. of to St. Aubin	6
" St. Aubin to w. line of Dubois	4
" crossing Dubois	8
" 281 ft. w. of Chene to Grandy	4
" 31 ft. e. of w. of Jos. Campau to 28 ft. w. of e. of Mitchell	6
" Mitchell to McDougall	4
" e. from McDougall 281 ft	6
" crossing Collins	6
" e. line of Collins to Dettloff ct	4
" Dettloff ct. to alley w. of Ellery pl	6
" alley w. of Ellery to alley w. of Mt. Elliott	4
" crossing Mt. Elliott from w. to e. line	6
" Canton to Helen	6
" alley s. of, Greenwood to Leroy pl	4
" alley s. of, alley e. of Riopelle to w. line of Orleans,	3
" alley s. of, crossing w. side of Orleans	4
" alley s. of, 20 ft. w. of e. of Collins to 25 ft. e. of w. of Moran	6
Hanover ave., crossing Russel e. side	4
Harmon ave., 16-in. main to e. line of Woodward	6
" e. line of Woodward to Oakland	4
Harper ave., Fifteenth to 134 ft. w. of Fourteenth	6
" 134 ft. w. of to Fourteenth	4
" crossing Fourteenth	6
" 29 ft. w. of e. of Thirteenth to 176 ft. w. of Twelfth..	6
" 176 ft. w. of to Twelfth	4
" Woodward to Russell	4
" Widman pl. to 184 ft. e. of Dubois	4
" 184 ft. e. of Dubois to w. line of Chene	6
" w. line of Chene to 28 ft. w. of e. of Mitchell	4
" 28 ft. w. of e. of Mitchell to w. line of McDougall Boulevard	6
" crossing McDougall Boulevard	8
" crossing Collins	8
" e. line of Collins to e. line of Mt. Elliott	6
" Baldwin to 433 ft. e. of Van Dyke	6
" Rohns to Holcomb	6
" Gratiot to Cadillac	6
" alley s. of, John R. to 350 ft. e. of same	4
" alley s. of, Brush st. e. 162 ft	6
Harrison ave.. crossing Michigan	12
" Michigan to Grand River	4
" alley w. of, Linden s. to Linden N	4
Harvey ave., Junction to 500 ft. w. of Campbell	4
Hastings st., s. line to 16-in. main in Jefferson	16
" Jefferson to Champlain	24
" 118 ft. s. of Congress to Fort	3
" Champlain to Monroe	3
" Congress to Clinton	6
" Clinton to s. line of Mullett	4
" crossing s. side of Mullett	8

LOCATION.	DIAM. INCHES.
Hastings st., Mullett to Catherine	12
" Catherine to Division	6
" 16 ft. s. of n. of Division to 30 ft. s. of n. of Alfred	8
" 30 ft. s. of n. of Alfred to Watson	6
" Watson to Canfield	10
" Canfield to Theodore	8
" s. line of Farnsworth to s. line of Medbury	6
" s. line of Medbury to Harper	8
" Harper to Piquette	6
" Piquette to s. line of Trombly	4
" s. line of Trombly to s. line of N. Boulevard	6
" crossing N. Boulevard	8
" n. line of N. Boulevard to Custer	4
" Custer to Marston	6
" first alley e. of alley s. of to 12 ft. s. of s. line of Canfield	3
" first alley e. of, 12 ft. s. of s. to 21 ft. n. of s. line of Canfield	4
" first alley e. of first alley s. of Garfield to Cracow pl.,	6
" second alley e. of, second alley s. of Garfield to first alley s. of same	6
Hazel st., 29 ft. e. of w. of Wabash to 21 ft. e. of w. of Thirteenth,	6
" 21 ft. e. of w. of Thirteenth to 96 ft. e. of same	4
" 96 ft. e. of Thirteenth to 156 ft. w. of Twelfth	3
" 156 ft. w. of Twelfth to Harrison	4
" 25 ft. w. of e. of Harrison to 25 ft. w. of e. of National	6
Hazelwood ave., e. from 10-in. main in Hamilton Boulevard 28 ft.	6
" 13 ft. w. of e. of Hamilton Boulevard to w. line of Woodward	4
" w. line of Woodward to 16 in. main	6
Heck pl., crossing n. side of Forest	4
" Forest to Hancock	3
Hecla ave., Merrick to 343 ft. n. of Kirby	4
" 687 ft. s. of s. of Piquette to Milwaukee	6
Heidelberg st., Jos. Campau to alley e. of same	6
" alley e. of McDougall to w. line of Elmwood	3
" crossing Elmwood w. side 39 ft	4
" Elmwood to Mt. Elliott	6
Helen ave., Jefferson to 4 ft. n. of s. of Mathews	6
" crossing Mack	6
" Gratiot to 192 ft. n. of Medbury	6
Hendricks st., St. Aubin to Dubois	3
" Dubois to alley w. of McDougall	4
" alley e. of McDougall to Elmwood	4
" Elmwood to 522 ft. w. of Mt. Elliott	6
" 522 ft. w. of to Mt. Elliott	4
Hendrie ave., Woodward to 550 ft. e. of John R.	4
" 550 ft. e. of John R. to w. line of Brush	6
" crossing Brush and St. Aubin	4
" crossing Hastings	6
" Dubois to 224 ft. e. of same	6
" 224 ft. e. of Dubois to e. line of Chene	4
" e. from e. line of Chene 148 ft	6
" 148 ft. e. of e. of Chene to e. line of Grandy	4
" e. line of Grandy to e. line of McDougall	6
" alley s. of, from 378 ft. w. of w. to 16 ft. w. of e. of Rivard	6

LOCATION.	DIAM. INCHES.
Hendrie Boulevard (s. side), crossing Collins, Ellery, Moran	6
" 32 ft. w. of e. of McDougall Boulevard to 12 ft. w. of e. of Collins	6
" 12 ft. w. of e. of Collins to 20 ft. w. of e. of Mt. Elliott	10
" 20 ft. w. of e. of Mt. Elliott to 12 ft. e. of w. of Frontenac Boulevard	8
" (s. side), crossing Mt. Elliott, Meldrum, Beaufait,	6
" (s. side), crossing Bellevue, Concord, Canton	6
" (s. side), crossing Helen	6
" (n. side), Mt. Elliott to e. side Frontenac ave.,	8
" Baldwin to 264 ft. e. of same	6
" 264 ft. e. of Baldwin to 24 ft. w. of e. of Van Dyke	4
" 24 ft. w. of e. of Van Dyke to w. line of Maxwell,	6
Henrietta ave., crossing Campbell	6
Henry st., alley e. of to Third	4
" Third to Cass	6
" Clifford to Woodward	4
Herbert st., 134 ft. w. of Lovett to Scotten	4
Hibbard ave., Jefferson to 202 ft. n. of Brinket	6
High st., National to alley w. of Trumbull	3
" alley w. of, Trumbull to Fourth	4
" Fourth to w. line of Third	3
" w. line of to Third	4
" Third to Grand River	6
" Grand River to 26 ft. e. of e. of Woodward	4
" 27 ft. e. of w. of Woodward to 3 ft. w. of e. of John R.	8
" 3 ft. w. of e. line of John R. to w. line of Beaubien	4
" w. line of Beaubien to St. Antoine	6
" St. Antoine to Rivard	4
" 23 ft. e. of w. of Rivard to 15 ft. e. of w. of Riopelle	10
Highland ave. (Highland Park), e. line of Hamilton Boulevard to 16 ft. w. of e. of Woodward	6
Hoffman st., River st. to Fort	8
Holborne ave., crossing Mt. Elliott w. side	6
" e. from Mt. Elliott 170 ft	4
Holbrook ave., Woodward to John R	6
Holcomb ave., Jefferson to Lewis	6
" Goethe to Mack	6
" 274 ft. s. of s. of Gratiot to Harper	6
Holden ave., Third to Cass	10
" Cass to Woodward	6
Holden road, Third to Fourth	4
" Fourth to N Boulevard s. line	8
" s. line of to 24-in. main in N. Boulevard	10
" Lincoln to Greenwood	4
Homer st., w. from Crane 215 ft	4
Hooker ave., e. from Grand River 63 ft.	4
" Sullivan to 596 ft. w. of Eighteenth	6
" 596 ft. w. of to Eighteenth	4
Horatio st., Livernois to Welch	4
" Welch to Howell	6
" Thirty-third to Thirty-second	6
" Scotten to Lasalle	6
Horton ave., Woodward to Oakland	4
Houghton ave., Holcomb to McClellan	4

LOCATION.		DIAM. INCHES.
Howard st.,	14 ft. w. of e. of Cavalry to 343 ft. w. of Junction	6
"	343 ft. w. of to Junction	4
"	Scotten to alley e. of	4
"	Twenty-fifth to Twenty-fourth	4
"	Twenty-fourth to w. side M. C. R. R. bridge	6
"	Twelfth to Tenth	6
"	alley s. of, Fourteenth to alley e. of same 190 ft	3
"	alley s. of, 333 ft. w. of to Tenth	4
"	alley s. of, Tenth to First	6
"	alley s. of, First to Shelby	4
Howell st.,	alley s. of, to n. line of Buchanan	6
"	n. from Horatio 680 ft	6
Hubbard ave.,	Fort to 335 ft. n. of Brandon	6
"	E. st. to Michigan	4
"	Michigan to Myrtle	6
"	alley w. of Howard to Porter	4
Hubbard Boulevard,	Myrtle to Visger	6
"	(e. side), Buchanan to Hancock	6
"	(e. side), 185 ft. s. of Warren to s. line of same,	6
"	(e. side), crossing Warren	4
"	(e. side), n. line of Warren to n. line of McGraw	6
"	(e. side), McGraw to Scovel pl	4
"	(e. side), Scovel pl. to 161 ft. s. of N. Boulevard,	6
"	(e. side), 161 ft. s. of, to N. Boulevard	4
"	(w. side), crossing Buchanan	6
"	(w. side), s. line of Hancock to n. line of McGraw	6
"	(w. side), s. from N. Boulevard 117 ft	6
"	(both sides), crossing Scovel, Moore and Wreford	6
Hudson ave.,	Vinewood to e. line of same	6
"	e. line of Vinewood to Twenty-sixth	4
"	Twenty-sixth to Grand River	6
"	w. line of Humboldt to 144 ft. w. of Eighteenth	4
"	144 ft. w. of, to Eighteenth	6
"	crossing e. side of Eighteenth	4
"	Fifteenth to Wabash	6
"	Seventh to 564 ft. w. of Greenwood	6
"	564 ft. w. of, to e. line of Greenwood	4
"	crossing w. side of Fourth	4
Humboldt ave.,	Michigan to s. line of Butternut	4
"	crossing Butternut	6
"	n. line of Butternut to s. line of Buchanan	4
"	crossing Buchanan	6
"	n. line of Buchanan to D. & B. C. R. R	4
"	s. line of Warren to McGraw	6
Hunt st.,	Dubois to alley w. of McDougall	4
"	alley e. of McDougall to Elmwood	4
"	27 ft. w. of e. of Elmwood to 438 ft. e. of e. of same	6
"	Ellery to Mt. Elliott	4
Hurlbut ave.,	crossing Jefferson to 21 ft. n. of same	6
"	n. from Mack 360 ft	6
Huron st.,	s. from Locust 295 ft	3
"	Locust to Bagg	6
Hussar st.,	Dragoon to Military	6
"	25 ft. w. of e. of Military to 204 ft. e. of e. of same	6

LOCATION.	DIAM. INCHES.
Illinois st., Brush to Russell	6
" Russell to St. Aubin	4
" St. Aubin to w. line of Dubois	8
" crossing Dubois	4
" Dubois to w. line Chene	3
" crossing Chene	4
" Chene to w. line of Grandy	3
" w. line of Grandy to Jos. Campau	6
" e. from McDougall 241 ft	8
" 241 ft. e. of McDougall to 4 ft. w. of w. of Collins	4
" 4 ft. w. of w. of Collins to 4 ft. e. of e. of same	6
" 193 ft. w. of to Moran	4
Indiana st., Beaubien to Russell	8
Ingersoll st., e. from Wesson 226 ft	4
Iron st., Wight to Jefferson	6
Iroquois ave., 6 ft. s. of Champlain to 21 ft. s. of n. of Agnes	8
" 21 ft. s. of n. of Agnes to 2 ft. n. of n. of St. Paul	6
" alley e. of, 5 ft. n. of s. of alley n. of Jefferson to 115 ft. n. of same	4
Irving st., Seventh to Greenwood	4
Ivy pl., Twenty-third to Grand River	6
Jackson st., Thirty-fifth to Thirty-fourth	6
" Thirtieth to Twenty-ninth	6
" Twenty-ninth to e. line of Scotten	4
Jay st., Riopelle to w. line of Jos. Campau	4
" crossing Jos. Campau w. to e. line	6
" e. line of Jos. Campau to 44 ft. w. of McDougall	4
" 44 ft. w. of McDougall to Elmwood	6
Jean ave. (e. of city limits), 9 ft. e. of w. of Gratiot to 12 ft. e. of w. of alley e. of Pennsylvania	4
Jefferson ave., First to Griswold	8
" Griswold to 18 ft. w. of e. of St. Antoine	10
" (s. side) 18 ft. w. of e. of St. Antoine to 18 ft. w. of e. of Orleans	6
" (n. side) 19 ft. w. of e. of Hastings to 28 ft. e. of w. of Orleans	10
" Dequindre to w. side of Belt Line R. R	6
" e. side of Belt Line R. R. to Hibbard	6
" McClellan to e. city limits	10
" e. from e. city limits to 178 ft. e. of e. of entrance to Driving Park	8
" 178 ft. e. of e. of Driving Park to 27 ft. w. of e. of Marshland road	6
" (n. side) 529 ft. w. of w. of Leib to 26 ft. e. of w. of same	6
" (n. side) 13 ft. w. of e. of Leib to 11 ft. e. of w. of Meldrum	8
" (n. side) 11 ft. e. of w. of Meldrum to 27 ft. e. of w. of Beaufait	6
" (n. side) 27 ft. e. of w. of Bellevue to 46 ft. e of w. of E. Boulevard	6
" (n. side) 46 ft. w. of e of E. Boulevard to 26 ft. e. of w. of Baldwin	6
" Second to Hastings	16
" Meldrum to Pumping Works (main No. 1)	42
" Crane to Pumping Works (main No. 3)	42
" alley s. of, alley w. of Griswold to alley w. of Woodward	4

LOCATION.	DIA M. INCHES.
Jefferson ave., alley s. of, alley w. of Bates to Randolph	4
" alley s. of, Brush to Beaubien	3
" alley s. of, Beaubien to 189 ft. e. of same	4
" alley n. of, 16 ft. e. of w. of Seyburn to 17 ft. w. of e. of same	4
" alley n. of, 27 ft. w. of e. of Van Dyke to e. line of same	6
" alley n. of, 15 ft. w. of e. of Parker to alley [illegible] of Iroquois	4
Joe st., Michigan to alley s. of Buchanan	6
John R. st., Woodward to Miami	12
" n. side Miami to s. side of Madison	4
" n. side Madison to Adams	4
" Adams to Columbia	6
" Columbia to Edmund	8
" Edmund to s. line Rowena	6
" s. line Rowena to Brady	8
" Brady to s. line of Canfield	6
" crossing Canfield	8
" n. line Canfield to s. line of N. Boulevard	6
" crossing N Boulevard s. side	8
" Horton to Hamlin	6
" 1 ft. n. of s. of Chandler to n. line of same	6
" crossing Melbourne	6
" 12 ft. n. of s. of Alger to 12 ft. s. of n. of same	6
" crossing King	6
" crossing Holbrook	6
Johnson st., Nineteenth to alley w. of Eighteenth	4
Jones st., Sixth to 160 ft. w. of Fifth	6
" 160 ft. w. of, Fifth to Cass	4
Jos. Campau ave., Atwater to Clinton	6
" 25 ft. n. of s. of Catherine to 20 ft. n. of s. of Jay,	8
" Jay to s. line of Gratiot	6
" s. line of Gratiot to St. Joseph	4
" St. Joseph to Trombly	6
" Trombly to 250 ft. n. of Milwaukee	4
" 250 ft. n. of Milwaukee to s. line of N. Boulevard,	6
" crossing N. Boulevard	8
" N. Boulevard to 10 ft. n. of Denton (w. side)	6
" alley e. of, Mullett to Jay	4
" alley e. of, Cleveland to Hendricks	3
" alley e. of, Hendricks to Hunt	4
" alley e. of, Hunt to Charlevoix	3
" alley e. of, Charlevoix to Heidelberg	4
Josephine ave., 16 in. main to 1,905 ft. e. of e. of Woodward	6
Joy st., Fifth to Fourth	4
" Fourth to alley e. of Third	6
" alley e. of Third to 43 ft. w. of e. of Second	4
" 43 ft. w. of e. of Second to 32 ft. w. of e. of Cass	8
Julia st., 11 ft. e. of w. of Hammond to Bushey	6
Junction ave., River to s. line of Fort	6
" s. line of Fort to Otis	8
Kanter ave., crossing Collins	6
" 185 ft. w. of Collins to Moran	4
" 166 ft. w. of to Mt. Elliott	4
" crossing e. side McDougall Boulevard	6
Kercheval ave., Mt. Elliott to Beaufait	8
" Field to Baldwin	4

LOCATION.	DIAM. INCHES.
King ave., 16-in. main in Woodward to 871 ft. e. of e. of Brush	6
Kinsman st., Twenty eighth to Scotten	4
Kirby ave., Vinewood to 247 ft. w. of Twenty-seventh	6
" 247 ft. w. of to Twenty-seventh	4
" 24 ft. w. of e. of Maybury to 219 ft. e. of e. of Sullivan	6
" crossing Humboldt	4
" Eighteenth to 87 ft. e. of Sixteenth	4
" 87 ft. e. of Sixteenth to 126 ft. w. of Fourteenth	6
" 126 ft. w. of to Fourteenth	4
" Fourteenth to Wabash	6
" Thirteenth to 19 ft. e. of w. of Twelfth	6
" 19 ft. e. of w. of Twelfth to 49 ft. e. of w. of Trumbull	8
" 49 ft. e. of w. of Trumbull to Cass	10
" 23 ft. w. of e. of Cass to 18 ft. w. of e. of Rivard	16
" crossing e. side of Rivard	
" e. from Russell 216 ft.	4
" St. Aubin to Chene	4
" 23 ft. w. of e. of Chene to 154 ft. e. of e. of same	6
" 154 ft. e. of e. of Chene to w. line of Grandy	3
" crossing Grandy	4
" crossing Collins	6
" 85 ft. w. of Moran to 438 ft. e. of e. of same	6
" connecting two mains in Mt. Elliott	6
" Concord to Canton	6
" e. from Helen 238 ft.	4
" Sheridan to Townsend	6
" Baldwin to 161 ft. e. of same	6
" 161 ft. e. of Baldwin to Van Dyke	4
Koch ave., 16-in. main to e. line of Woodward	6
" e. line of Woodward to w. line of Oakland	4
" crossing w. line of Oakland 26 ft.	6
Kolb st., Crane ave. to 470 ft. e. of e. of same	6
Labrosse st., crossing e. side of Twelfth	6
" e. line of Twelfth to 430 ft. w. of Tenth	4
" 430 ft. w. of to Tenth	3
" Fifth to Fourth	4
" alley s. of, alley e. of, Twelfth to Fourth	4
Lady's lane, n. from Dry Dock st. 214 ft.	4
Lafayette ave., Artillery to Dragoon	6
" Dragoon to 123 ft. e. of same	4
" 123 ft. e. of Dragoon to 315 ft. w. of Junction	6
" 315 ft. w. of to Junction	4
" 26 ft. w. of e. of McKinstry to e. line of Clark	6
" e. from Scotten 256 ft.	4
" 256 ft. e. of to 352 ft. e. of Scotten	6
" Twenty-fourth to e. line of Twenty-second	4
" Eighteenth to 110 ft. w. of w. line of Seventeenth	6
" 110 ft. w. of w. of to Seventeenth	4
" alley w. of Sixteenth to Fifteenth	4
" Fifteenth to w. line of Fourteenth	3
" Fourteenth to Twelfth	4
" crossing Twelfth e. side	6
" M. C. R. R. bridge to 743 ft. w. of Tenth	3
" 743 ft. w. of to Tenth	4
" Shelby to Griswold	4
" alley s. of, Tenth to Fifth	4
" alley s. of, Fourth to First	4

LOCATION.	DIAM. INCHES.
Lafayette ave., alley s. of, First to Wayne	6
" alley s. of, Shelby to Griswold	6
Lafferty pl., Howard to s. side M. C. R. R.	6
Lambie pl., crossing w. side of Twenty-third	4
" crossing from w. to e. of Twenty-second	4
" Twenty-second to Twenty-first	6
Lambert st., crossing e. side of Mt. Elliott	6
" Concord to Canton	4
" e. from Baldwin 235 ft	6
" 235 ft. e. from Baldwin to Van Dyke	4
Langley ave., Seventh to 141 ft. e. of e. of same	6
" 141 ft. e. of e. of Seventh to Fourth	4
Lauman st., crossing e. side of Vinewood	4
" e. side of Vinewood to Twenty-seventh	6
Lansing ave., Fort to 159 ft. n. of Christiancy	6
" 357 ft. s. of Dix to Toledo	6
Larned st., Fifth to Fourth	4
" Fourth to Third	8
" alley w. of to Woodward	8
" Third to Hastings	16
" Bates to Brush	4
" St. Antoine to Dequindre	4
" Riopelle to St. Aubin	12
" St. Aubin to w. line of Elmwood	4
" w. line of Elmwood to 748 ft. e. of same	6
" 33 ft. w. of e. of Leib to 15 ft. w. of e. of same	6
" 15 ft. w. of e. of Leib to alley e. of same	4
" w. line of Mt. Elliott to main 26 ft	4
" Mt. Elliott to 25 ft. w. of e. of Meldrum	6
" w. from Helen 156 ft	4
" alley s. of, Third to First	8
" alley s. of, First to Griswold	4
" alley s. of, Shelby to Griswold	8
" alley s. of, crossing Griswold (e. side) to 12 ft. w. of e. of same	4
" alley s. of, 12 ft. w. of e. of Griswold to 8 ft. w. of e. of alley w. of Woodward	8
La Salle ave., Michigan to Horatio	6
" Kirby to McGraw	6
Lauderdale ave., Campbell to 273 ft. w. of w. of Junction	6
" 273 ft. w. of to Junction	4
Laurel st., Wabash to Grand River	4
Lawrence ave., 16-in. main in Woodward to 1,212 ft. w. of w. of same,	6
Leach st., w. from Crane 215 ft	4
Leavitt ave., Livernois to Wesson	4
" 25 ft. e. of w. of Wesson to 308 ft. e. of e. of same	6
Ledyard st., Third to Cass	6
Leib st., Wight to Jefferson	6
" 8 ft. s. of n. of Jefferson to 24 ft. s. of n. of Congress	8
" Congress to Champlain	4
" 42-in. main in Champlain to 18 ft. s. of n. of Monroe	8
Leicester ct., 16-in. main to e. line of Woodward	6
" e. from Woodward 1,379 ft.	4
Leland st., 2 ft. w. of e. of Brush to Beaubien	6
" Beaubien to Russell	4
" Russell to McDougall	8
" McDougall to Collins	3

LOCATION.	DIAM. INCHES.
Leland st., w. line of Collins to 6 ft., e. of e. of same	6
" 216 ft. w. of Moran to Gratiot	4
Lemay ave. (e. of city limits), Jefferson n. 607 ft	6
Leroy pl., n. from Forest 251 ft	3
Lessing st, e. from McClellan 158 ft	4
Leverette st., Twelfth to Tenth	4
" Eighth to Seventh	4
" alley s. of Tenth to Eighth	4
Lewis st., Fourth to Cass	4
" alley s. of, alley e. of Third to Second	4
Lincoln ave., Grand River main to alley n. of	4
" crossing Calumet n. side 30 ft	8
" n. line Calumet to Holden	6
" crossing n. side Holden	8
" n. line of Holden to Milwaukee	6
" crossing s. side N. Boulevard 87 ft	6
" alley w. of, alley n. of Grand River to s. line of Brainard	4
" alley w. of, s. line of Brainard to 30-in. main in Calumet	6
Linden st., 26 ft. e. of Twenty-sixth to Twenty-fifth	4
" Twenty-fourth to Tillman	4
" Maybury to 137 ft. e. of e. of Humboldt	4
" 137 ft. e. of e. of Humboldt to Eighteenth	6
" Eighteenth to Harrison	4
Livernois ave., Dix to M. C. R. R	8
" M. C. R. R. to n. city limits	10
Locust st., Wabash to Harrison	4
" National to 30 ft. e. of same	4
" 30 ft. e. of National to alley w. of Trumbull	3
" alley e. of Trumbull to Fourth	4
" Fourth to Grand River	6
Lombard terrace, alley w. of Avery to Twelfth	6
Longfellow ave., 16-in. main to w. line of Woodward	6
Lorman ave., Crane to Belvedere	4
Lothrop ave., Hamilton Boulevard to Woodward	6
Louis ave., Crane to Holcomb	4
" 28 ft. w. of e. of Holcomb to 83 ft. e. of e. of same	6
Lovett ave., Michigan to n. line of Buchanan	6
" Rich to 93 ft. n. of n. of Horatio	4
" 93 ft. n. of Horatio to 264 ft. n. of Herbert	6
" alley w. of Visger to Jackson	6
Ludden st., Gratiot to Mt. Elliott	4
Lyman st., Crystal to Orleans	4
" 4 ft. w. of w. of Chene to 23 ft. w. of e. of same	6
Lysander st., crossing e. side of Thirteenth 21 ft	6
" e. line of Thirteenth to Avery	4
" 40 ft. w. of e. of Lincoln to 19 ft. w. of e. of Fourth	6
McArthur st., Vinewood to 70 ft. e. of e. of same	6
" 70 ft. e. of Vinewood to Twenty-seventh	4
McClellan ave., Jefferson to Marrietta	6
" Marrietta to Mack	8
" s. line of Mack to 144 ft. n. of Emmons	10
" n. from Gratiot 299 ft	8
McDougall ave., Atwater to Guoin	6
" Guoin to Wight	0
" Wight to Clinton	6

	LOCATION.	DIAM. INCHES.
McDougall ave.,	35 ft. s. of n. of Clinton to 28 ft. n. of s. of Catherine	8
"	crossing Waterloo, Cleveland and Arndt	8
"	Preston to Gratiot	8
"	Gratiot to Canfield	4
"	Canfield to 187 ft. n. of Garfield	6
"	187 ft. n. of Garfield to Forest	8
"	Forest to Hancock	6
"	Theodore to Farnsworth	6
"	crossing Ferry	6
"	Palmer to Hendrie	6
"	alley e. of, Millett to 85 ft. n. of n. of Chestnut	4
"	alley e. of, 85 ft. n. of n. of Chestnut to 23 ft. n. of s. of Antietam	6
"	alley e. of, Waterloo to s. line of Cleveland	3
"	alley e. of, crossing Cleveland	4
"	alley e. of. Cleveland to s. line of Arndt	3
"	alley e. of, crossing Arndt	6
"	alley e. of, n. line of Arndt to Preston	3
McDougall Boulevard,	22 ft. n. of s. of Hendrie Boulevard to 29 ft. s. of n. of Griffin	6
McGraw ave.,	Scotten to 76 ft. e. of La Salle	4
"	76 ft. e. of La Salle to Twenty-sixth	6
"	Twenty-sixth to Grand River	4
"	Winslow to Sullivan	6
"	Sullivan to Sixteenth	4
McGregor st.,	Campbell to Junction	6
McKinstry ave.,	River st. to n. line of Toledo	6
"	Brandon to Plumer	6
"	alley w. of, Plumer to all y s. of same	4
McMillan st.,	25 ft. w. of e. of Livernois to 42 ft. e. of w. of Military,	6
"	Campbell to 319 ft. w. of Junction	6
"	319 ft. w. of to Junction	4
Mack ave.,	Riopelle to St. Aubin	6
"	e. from St. Aubin 300 ft	4
"	100 ft. w. of to w. line of Dubois	3
"	crossing Dubois	4
"	e. line of Dubois to w. line of Chene	3
"	crossing Chene	4
"	Chene to e. line of Grandy	3
"	Grandy to Jos. Campau	6
"	e. from McDougall 402 f	4
"	Gratiot to Cadillac from main No. 2	42
"	Gratiot to Mt. Elliott	4
"	crossing Mt. Elliott w. to e. line	6
"	e. line of Mt. Elliott to Townsend	4
"	Townsend to Baldwin	6
"	Beals to 167 ft. e. of Parker	8
"	659 ft. w. of to 577 ft. w. of Fischer	8
"	207 ft. w. of to 65 ft. e. of Crane (s.)	8
"	30 ft. w. of w. of Rolfe pl. to 16 ft. w. of e. of same	8
"	McClellan to Pennsylvania	8
"	Pennsylvania to e. line of Hamilton	6
"	(e. of city limits) e. line of Hamilton to e. line of Park,	8
"	(e. of city limits) e. line of Park to e. line of Montclair	6
Macomb st.,	St. Antoine to Elmwood	4
"	alley s. of, alley w. of to w. line of Brush	3
"	alley s. of, w. line of Brush to St. Antoine	4

	LOCATION.	DIAM. INCHES.
Madison ave.	(both sides) Witherell to John R.	4
"	Randolph to 18 ft. e. of w. line of Brush	6
"	Brush to Beaubien	8
"	Beaubien to St. Antoine	4
"	alley s. of, John R. to Randolph	4
Magnolia st.,	Vinewood to Twenty-seventh	4
"	crossing Twenty-fourth	4
"	Maybury to Sullivan	4
"	Sullivan to w. line of Humboldt	8
"	crossing Humboldt	4
"	e. line of Humboldt to Eighteenth	3
"	Fifteenth to Fourteenth	4
"	Wabash to Thirteenth	8
"	Thirteenth to Harrison	4
Mansur st.,	Harper to 78 ft. s. of Piquette	4
"	78 ft. s. of Piquette to 34 ft. s. of n. of same	6
Maple st.,	Gratiot to Orleans	8
"	Orleans to St. Aubin	4
"	St. Aubin to w. line of Dubois	6
"	crossing Dubois	8
"	Dubois to Elmwood	6
Marcy st.,	Greenwood to 158 ft. w. of Fourth	4
"	158 ft. w. of to Fourth	8
Marietta st.,	e. from McClellan 521 ft.	4
"	521 ft. e. of e. of McClellan to 109 ft. w. of w. of Pennsylvania	6
Mark st.,	Thirteenth to 176 ft. w. of Twelfth	6
"	176 ft. w. of to Twelfth	4
Marston ct.,	16-in. main in Woodward to 251 ft. e. of e. of John R.	6
"	243 ft. w. of w. of Oakland to Hastings	6
Martin pl.,	10-in. main in Woodward to 20 ft. w. of e. of John R.	8
Maxwell ave.,	alley n. of Jefferson to n. line of Champlain	4
"	18 ft. s. of n. of Champlain to 16 ft. n. of s. of Tonti.	6
Maybury ave.,	Michigan to n. line of Ash	6
"	n. line of Ash to Stanley	8
Mechanic st.,	Brush to Beaubien	4
Medbury ave.,	Woodward to 364 ft. e. of e. of John R.	4
"	364 ft. e. of e. of John R. to 460 ft. e. of e. of same	3
"	22 ft. w. of e. of Brush to 128 ft. e. of e. of same	8
"	223 ft. w. of w. of St. Antoine to 149 ft. e. of e. of same	3
"	140 ft. w. of w. of Hastings to 168 ft. e. of e. of same,	3
"	194 ft. w. of w. of Rivard to 22 ft. w. of e. of same	3
"	22 ft. w. of e. of Rivard to e. line of same	4
"	730 ft. w. of to w. line of St. Aubin	3
"	w. line of St. Aubin to Jos. Campau	4
"	Mitchell to e. line of Collins	6
"	538 ft. w. of to 168 ft. e. of Mt. Elliott	6
"	Canton to Helen	6
"	Helen to Frontenac	4
"	Baldwin to Van Dyke	6
"	alley s. of, John R. to 350 ft. e. of same	4
"	alley s. of, crossing Brush	6
Melbourne ave.,	13 ft. w. of e. of Woodward to 41 ft. e. of e. of Brush	8
Meldrum ave.,	Wight to Jefferson	10
"	Jefferson to 46 ft. n. of Fort	6

LOCATION.	DIAM. INCHES.
Meldrum ave., 46 ft. n. of Fort to 360 ft. n. of Kercheval	4
" 360 ft. n. of to 642 ft. n. of Kercheval	6
" Arndt to Gratiot	6
" 168 ft. s. of Forest to 30 ft. n. of s. of same	6
" crossing N. Boulevard	6
" Jefferson to Congress	42
Merrick ave., Vinewood to Twenty-seventh	4
" 20 ft. w. of e. of Twenty-fifth to 26 ft. e. of w. of Twenty-fourth	6
" Twenty-third to Tillman	4
" Tillman to Williams	6
" 27 ft. w. of e. of Maybury to 212 ft. e. of e. of Sullivan,	6
" 132 ft. w. of, to Seventeenth	4
" w. line of Wabash to Twelfth	6
" Twelfth to 35 ft. w. of e. of Avery (s.)	4
" 35 ft. w. of e. of Avery (s.) to 26 ft. e. of w. of Avery (n.) 99 ft	6
" 26 ft. e. of w. of Avery (n.) to Trumbull	4
" Lincoln to e. line of Greenwood	4
" 25 ft. w. of e. of Seventh to 20 ft. w. of e. of Greenwood (in s. lawn)	6
" e. line of Greenwood to 136 ft. w. of Fourth	3
" 136 ft. w. of to Fourth	4
" Third to 26 ft. e. of w. of Second	4
" 26 ft. e. of w. of Second to 21 ft. w. of e. of same	6
" 21 ft. w. of e. of Second to Cass	4
" alley s. of, crossing e. side of Greenwood	4
" alley s. of, e. line of Greenwood to alley w. of Fourth	3
Miami ave., Gratiot to Witherell	16
" n. side of, John R. to Witherell	4
" alley w. of, alley s. of to Gratiot	6
" alley w. of, Gratiot to 80 ft. s. of Witherell	4
" alley e. of, Randolph to John R.	4
Michigan ave. (s. side), crossing W. Boulevard	6
" Livernois to Twenty-fourth	6
" Twenty-fourth to Foundry	8
" Vinewood to Tenth	24
" Tenth to First	8
" First to Washington	10
" Cass to Woodward	24
" alley s. of Cass to Shelby	4
" private alley s. of, Shelby to 110 ft. e. of same	3
Middle st., alley s. of. Grand River to 230 ft. e. of Clifford	4
Military ave., River st. to 250 ft. n. of Wabash R. R	6
" 62 ft. n. of, Anthon to Toledo	6
Miller st., crossing Seventh	4
" Seventh to Sixth	3
Milwaukee ave., 36 ft. w. of Sullivan to 4 ft. w. of w. of Eighteenth,	4
" 4 ft. w of w. of Eighteenth to w. line of Sixteenth,	6
" crossing Fourteenth	6
" Twelfth to w. line of Avery	6
" Lincoln to Beaubien	6
" Beaubien to w. line of Riopelle	4
" w. line of Riopelle to Dubois	6
" Dubois to Chene	4

LOCATION.	DIAM. INCHES.
Milwaukee ave., 2 ft. w. of e. of McDougall Boulevard to w. line of Collins	6
" crossing Collins	8
" w. line of Mt. Elliott to 2 ft. w. of e. of same	6
Miner ave., e. from Crane 336 ft	4
" 336 ft. e. of Crane to Holcomb	6
Minnie ave., 23 ft. n. of River st. to 582 ft. s. of Fort	6
" 582 ft. s. of to Fort	4
Mitchell ave., n. from Gratiot 265 ft	6
" 265 ft. n. of Gratiot to Canfield	4
" Canfield to Harper	6
" n. from Harper 324 ft	4
" 324 ft. n. of Harper to Trombly	6
" Trombly to N. Boulevard	4
" crossing s. side of N. Boulevard	8
Mohawk st., crossing Vinewood e. side	4
Monroe ave., Cadillac square to Randolph	12
" Randolph to St. Antoine	8
" St. Antoine to Elmwood	4
" 90 ft. n. of Cadillac square to Farmer	3
" 216 ft. w. of to 15 ft. e. of w. of Leib	4
" 15 ft. e. of w. of Leib to 26 ft. e. of w. of Mt. Elliott,	6
" 185 ft. w. of. to Helen	4
" alley s. of. alley n. of Cadillac square to Randolph	4
" alley s. of. Brush to 8-in. main in Beaubien	4
" alley s. of. 8 in. main in Beaubien to 261 ft. e. of same,	8
" alley s. of. 261 ft. e. of Beaubien to St. Antoine	4
Montcalm st., Cass to main in Clifford	3
" main in Clifford to alley e. of Woodward	6
" alley e. of Woodward to Brush	4
" Brush to w. line of Beaubien	8
" w. line of Beaubien to Hastings	6
" Hastings to Russell	8
" alley s. of. 240 ft. w. of to Beaubien	4
Montclair ave. (e. of city limits), 6-in. pipe in Mack to 596 ft. n. of n. line of Canfield	6
Montieth st., Vinewood to Twenty-seventh	6
Moore pl., 14 ft. e. of w. of Scotten to e. side Hubbard Boulevard	6
" 25 ft. w. of e. of Twenty-sixth to 169 ft. e. of e. of same	6
Moran st., Gratiot to Dane	6
Morrell st., River st. to Toledo	6
" alley w. of, 21 ft. n. of s. of Brandon to 4 ft. n. of s. of alley s. of Plumer	6
Mott ave., 16-in. main to e. line of Woodward	6
" e. from Woodward 558 ft	4
Mt. Elliott ave., 148 ft. s. of Wight to 20 ft. n. of s. of Jefferson	6
" 25 ft. s. of n. of Jefferson to 285 ft. s. of Kerche-	6
" val	6
" 285 ft. s of Kercheval to Preston	8
" Preston to Mack	10
" Mack to Gratiot	8
" Gratiot to s. line of Hendrie Boulevard (e. side)	4
" crossing Boulevard	8
" n. line of Boulevard to 300 ft. n. of Griffin	4
" 300 ft. n. of Griffin to Forest Lawn cemetery	6
" (w. side) Gratiot to Warren	6
" (w. side) Harper to 182 ft. s. of	6

LOCATION.	DIAM. INCHES.
Mullett st., Gratiot to Chene	30
" St. Antoine to 5 ft. w. of w. of McDougall	4
" 5 ft. w. of w. of McDougall to e. line of same	6
" e. line of McDougall to Elmwood	4
Mulberry st., Thirteenth to Twelfth	4
Myrtle Boulevard, Hubbard Boulevard to alley w. of Twenty-sixth,	6
Myrtle st., alley w. of Twenty-sixth to Grand River	6
Nall st., w. line of Vinewood to 12 ft. e. of w. of Twenty-seventh,	6
Napoleon st., Brush to w. line of Beaubien	4
" crossing Beaubien	6
" e. line of Beaubien to Russell	4
National ave., Michigan to Grand River	6
Navarre st., McClellan to 425 ft. e. of e	6
Newark st., Twentieth to Nineteenth	6
Newberry ave., Cavalry to 341 ft. w. of Junction	6
" 341 ft. w. of, to Junction	4
Newland ave., 22 ft. n. of s. of Gratiot to s. line of Medbury	6
Newton ave., 1,264 ft. w. of to Jos. Campau	4
Newport ave., 70 ft. s of n. of Jefferson to 397 ft. n. of same	6
Nineteenth st., Fort to Baker	4
" crossing Porter s. to n. line	6
" Baker to Newark	6
" alley w. of, 197 ft. s. of to Rose	3
Noble st., Seventh to Sixth	4
" Greenwood to 150 ft. w. of Fourth	4
" 150 ft. w. of to Fourth	3
Norton ave., 162 ft. w. of w. of Wesson to 25 ft. e. of w. of same	6
" 25 ft. e. of w. of Wesson to 154 ft. e. of alley e. of Wesson	4
" 154 ft. e. of alley e. of Wesson to 226 ft. e. of same	6
" Junction to 386 ft. e. of same	4
" 386 ft. e. of Junction to Thirty-first	6
N. Boulevard, 14 ft. w. of w. of Hubbard Boulevard to 10-in. main in Grand River	16
" Grand River 10-in. main to 30-in. main in Collins	24
" (n. side) 330 ft. w. of w. of Grand River to 639 ft. e. of e. of same	4
" (n. side) 1,103 ft. w. of w. of Sullivan to 100 ft. w. of same	4
" (n. side) 228 ft. w. of w. of Eighteenth	6
" (n. side) e. to w. line of Eighteenth	4
" (n. side) 5 ft. w. of w. of Woodward to 8-in. main and from 16-in. main to 3 ft. e. of e. of same	6
" (n. side) crossing Woodward between 8 and 16-in. mains	8
" (n. side) St. Aubin to 49 ft. e	4
" (n. side) 20 ft. e. of w. of Dubois e. 174 ft	4
" (s. side) 16 ft. w. of e. of Hubbard Boulevard to 9 ft. e. of e. of Grand River	4
" (s. side) 33 ft. w. of e. of Sullivan to 146 ft. e. of same,	4
" (s. side) crossing Eighteenth and Fourteenth	4
" (s. side) 367 ft. w. of Twelfth to e. line	4
" (s. side) crossing Greenwood e. side	4
" (s. side) 15 ft. w. of e. curb of Greenwood to 69 ft. e. of same	4
" (s. side) 11 ft. e. of w. of Cass to 13 ft. e. of e. of same	4

LOCATION.	DIAM. INCHES.
N. Boulevard, (s. side) 8-in. main in Woodward to 100 ft. e. of Rivard	4
" (s. side) w. of w. of Chene 27 ft.	4
" (s. side) 40 ft. w. of e. of Mitchell to 64 ft. e. of e.	4
Oakland ave., Piquette to Trombly	6
" Milwaukee to s. line of Boulevard	4
" s. line of N. Boulevard to 24-in. main 87 ft.	6
" 24-in. main in N. Boulevard to 27 ft. n. of s. of Horton	10
" Horton to Hamlin	6
" Hamlin to Sidney	10
" Belmont to Harmon	10
" Harmon to 130 ft. n. of Woodland	8
Orchard st., Trumbull to Sixth	6
" Sixth to w. side Elton Park	4
" e. side Elton Park to First	4
Orleans st., Atwater to Jefferson	10
" Jefferson to 100 ft. n. of n. of Wilkins	8
" Congress to 75 ft. n. of n. of Wilkins	24
" s. line of Scott to Hale	30
" s. line of Scott to Hale	6
" crossing Leland s. side	6
" Alexandrine to s. line of Canfield	6
" crossing s. side of Canfield 30 ft.	30
" Garfield to 252 ft. n. of	4
" 252 ft. n. of Garfield to 195 ft. n. of Forest	6
" Trombly to Lyman	4
" 2 ft. s. of s. of Milwaukee to 26 ft. s. of n. of same	6
Ottawa st., e. from Thirteenth 130 ft.	3
Otis st., e. from Junction 300 ft.	4
" 300 ft. e. of Junction to alley w. of Thirty-first	6
Owen ave., 16-in. main in Woodward to 1,220 ft. e. of Woodward	6
Pallister ave., 280 ft. w. of to Hamilton Boulevard	6
" crossing w. side of Woodward	6
Palmer ave., Woodward to 254 ft. w. of w. of Brush	4
" 254 ft. w. of to w. line of Brush	6
" crossing w. side of Brush	4
" crossing e. side of Brush	6
" 22 ft. w. of e. of Beaubien to 178 ft. e. of same	6
" crossing Beaubien and St. Antoine n. and s. sides	4
" crossing Hastings w. to e. lines	6
" crossing Russell and St. Aubin	4
" e. line of St. Aubin to 129 ft. w. of Dubois	6
" 129 ft. w. of Dubois to e. line of Grandy	4
" Mitchell to McDougall	6
" crossing w. side of Moran	6
" 20 ft. e. of w. of Moran to 190 ft. e. of same	4
" 190 ft. e. of e. of Moran to 300 ft. e. of same	6
" 4 ft. e. of w. of Mt. Elliott to 159 ft. e. of Meldrum	6
" Townsend to 235 ft. e. of Baldwin	6
" 235 ft. e. of Baldwin to Van Dyke	4
" alley s. of (or private st. n. of Ferry) 362 ft. w. of to Rivard	3
" alley s. of (or private st. n. of Ferry) crossing w. side of Rivard	4
Park ave., Dix to Toledo	6
" (east of city limits) Mack to 645 ft. s. of Shoemaker	6

LOCATION.	DIAM. INCHES.
Park pl. (e.) Michigan to s. line of State	4
" crossing State	6
Park st., Woodward to Columbia	16
" Columbia to Bagg	8
" Bagg to Peterboro	6
" Woodward to Washington	6
Park View ave., crossing s. side of Jefferson	6
Parker ave., 6 ft. n. of s. of alley n. of Jefferson to 250 ft. n. of Coe,	6
" 842 ft. s. of, to 534 ft. n. of Mack	6
Parkman ave., 473 ft. w. of Seventh to Hamilton Boulevard	4
" w. line of Woodward to 16-in. main	6
Parsons st., Cass to Woodward	8
Pennsylvania ave., Jefferson to 620 ft. n. of n of Kercheval	6
" 145 ft. s. of Mack to 50 ft. n. of Elsa	6
Perrien Park, 25 ft. w. of e. of Chene e. 4[illegible]0 ft	4
Perry st., Humboldt to Eighteenth	4
" Harrison to Twelfth	6
" National to alley w. of Trumbull	4
" alley e. of, Trumbull to Grand River	4
" alley s. of, alley w. of Eighth to alley w. of Sixth	4
Petersboro st., Cass to Woodward	4
Philadelphia ave., e. from Russell 389 ft.	4
Pierce st., Dequindre to Jos. Campau	4
Pine st., crossing e. side of Twelfth	4
" e. line of Twelfth to National	3
" National to Grand River	4
Pitcher st., Seventh to Sixth	4
" Greenwood to 150 ft. w. of Fourth	4
" 150 ft. w. of to Fourth	3
" 14 ft. e. of w. of Third to 42 ft. w. of e. of Second	10
" 42 ft. w. of e. of Second to 18 ft. w. of e. of Cass	12
Pingree ave., Hamilton Boulevard to Woodward	6
Piquette ave., Sullivan to Eighteenth	4
" Fourteenth to e. line of same	6
" e. line of Fourteenth to Wabash	4
" Twelfth crossing e. side	6
" e. line of Twelfth to w. line of Avery	4
" Lincoln to Trumbull	6
" Greenwood to 124 ft. e. of e. of Fifth	6
" Woodward to Beaubien	4
" Beaubien to Russell	6
" Dubois to 186 ft. e. of e. line of same	6
" 186 ft. e. of e. line of Dubois to e. line of Chene	4
" e. line of Chene to Grandy	6
" Mitchell to 32 ft. e. of e. of McDougall Boulevard	6
" 32 ft. e. of e. of Boulevard to w. line of Collins	4
" w. line of Collins to 326 ft. w. of Mt. Elliott	6
" 326 ft. w. of to Mt. Elliott	4
Pleasant ave., n. from River st. 515 ft	4
Plum st., Trumbull to alley e. of	6
" alley e. of Trumbull to Second	4
Plumer st., Livernois to Welch	4
" Wesson to 283 ft. w. of Junction	6
" 283 ft. w. of Junction to w. line of McKinstry	4
" crossing w. side of McKinstry	6
" alley s. of, alley w. of Morrell to 14 ft. w. of alley w. of McKinstry	6
" alley s. of, 614 ft. w. of to alley w. of McKinstry	4

LOCATION.	DIAM. INCHES.
Pollard st., 1,242 ft. w. of to Jos. Campau	4
Poplar st., Twenty-fourth to 184 ft. w. of Twenty-third	6
" 184 ft. w. of Twenty-third to Tillman	4
" Maybury to 376 ft. e. of same	4
" 51 ft. w. of Sullivan to Humboldt	6
" w. line of Fifteenth to 110 ft. e. of Wabash	4
" 110 ft. e. of e. of Wabash to Thirteenth	6
Porter st., crossing Campbell	6
" Ferdinand to McKinstry	4
" 8 ft. e. of e. of Scotten to 21 ft. e. of e. of same	4
" 21 ft. e. of e. of Scotten to 14 ft. w. of e. of Hubbard	6
" Vinewood to w. line of W. Boulevard	6
" e. line of W. Boulevard to Twenty-second	4
" 22 ft. e. of w. of Twenty-second to 20 ft. w. of e. of Twentieth	8
" 20 ft. w. of e. of Twentieth to 30 ft. w. of e. of Fourteenth	10
" e. from Fourteenth 172 ft	3
" Thirteenth to 210 ft. w. of Twelfth	4
" 210 ft. w. of, to Twelfth	3
" 31 ft. w. of e. of Fourteenth to 9 ft. w. of w. of Tenth.	12
" alley s. of, 8 ft. w. of e. of Thirteenth to 23 ft. e. of e. of same	4
" alley s. of, 23 ft. e. of e. of Thirteenth to alley e. of same	3
" alley s. of, Twelfth to First	4
Prentiss ave., Greenwood to alley w. of Fourth	4
" Third to Cass	4
" alley s. of, from Second e. 150 ft	3
Preston st., McDougall to Mt. Elliott	4
Private road, private way (e. of Russell), s. from Clay 405 ft	4
Pulford ave., Gratiot to Mt. Elliott	4
" Meldrum to Beaufait	4
Putnam ave., 22 ft. w. of e. of Sullivan to 221 ft. e. of e. of same	6
" Fourteenth to Wabash	4
" w. line of Thirteenth to 185 ft. w. of Twelfth	4
" 185 ft. w. of, to Twelfth	3
" Twelfth to Trumbull	4
" Lincoln to Fourth	4
" Third to 323 ft. e. of same	4
" 323 ft. e. of Third to alley w. of Second	6
" 4 ft. w. of e. of alley w. of Cass to Cass (n. lawn),	6
" 5 ft. e. of w. of alley e. of Second to w. line of Cass (s. lawn)	6
" w. line of Cass to 60 ft. w. of Woodward	4
" 60 ft. w. of to Woodward	6
Railway ave., Scotten to La Salle	6
Randall st., crossing w. side of Twenty-third 26 ft	4
Randolph st., alley s of Atwater to Jefferson (not in service)	4
" Atwater to 24-in. main in Cadillac square	8
" Larned to Congress	4
" Congress to s. line of Gratiot	6
" crossing Gratiot	10
" Gratiot to Adams	6
" alley e. of, 50 ft. s. of, Fort to Champlain	4
" alley e. of, alley s. of Macomb to Gratiot	4
Ranspach st., Livernois to Hammond	4

LOCATION.	DIAM. INCHES.
Raynor st., Clinton to Gratiot	4
Reed pl., 335 ft. w. of to Greenwood	4
" Greenwood to 36 ft. w. of Fourth	3
" 36 ft. w. of to Fourth	4
Reeder ave., 438 ft. w. of Campbell to Junction	4
Regular ave., 8 ft. w. of w. of Military to Cavalry	6
Reservoir grounds, n. of basin to 30-in. branch	24
" s. and w. sides of basin	24
Rich st., Twenty-eighth to Clark	6
" Clark to Scotten	4
" Vinewood to 204 ft. e. of same	4
" 204 ft. e. of Vinewood to Twenty-seventh	6
Richard st., main in Seyburn to 6 ft. w. of e. of same	6
Riopelle st., Atwater to Jefferson	8
" Jefferson to Larned	12
" Larned to 36 ft. s. of n. of Gratiot	8
" 36 ft. s. of n. of Gratiot to High	10
" High to Adelaide	8
" Hale to Rowena	30
" Adelaide to s. line of Farnsworth	6
" Frederick to Kirby	6
" alley w. of, 21 ft. n. of s. of Willis to 21 ft. n. of s. of Canfield	4
" alley e. of, Willis to Canfield	4
" alley e. of, Garfield to 233 ft. n. of same	4
" alley e. of, 233 ft. n. of Garfield to alley s. of Hancock,	6
Rivard st., Atwater to Jefferson	8
" Jefferson to Clinton	10
" Clinton to 9 ft. s. of Mullett	6
" Mullett to Gratiot	10
" Gratiot to 30 ft. n. of s. of High	4
" 30 ft. n. of s. of High to 27 ft. s. of n. of Winder	10
" 27 ft. s. of n. of Winder to 25 ft. n. of s. of Division	8
" 25 ft. n. of s. of Division to Watson	4
" Brady to Alexandrine	30
" Eliot to 90 ft. s. of Warren	4
" 90 ft. s. of Warren to 21 ft. n. of s. of Farnsworth	6
" 21 ft. n. of s. of Farnsworth to 36 ft. n. of s. of Kirby	16
" Kirby to 221 ft. n. of Palmer	4
" 221 ft. n. of Palmer to alley n. of Harper	6
" 125 ft. n. of Harper to 12 ft. n. of s. of Piquette	6
" crossing Piquette	4
" 5 ft. s. of to 153 ft. n. of N. Boulevard	6
" 153 ft. n. of N. Boulevard to Clay	4
" n. from Clay 1,178 ft	6
" Larned to Congress	4
River st., 55 ft. w. of w. of Dearborn to w. line of city limits	6
" w. line of city limits to Campau	6
" Campau to Pleasant	8
" Pleasant to 75 ft. e. of Swain	6
" 525 ft. w. of Twenty-fourth to w. side of M. C. R. R. tracks	8
" crossing M. C. R. R. from w. to e. side 270 ft	6
" e. side of M. C. R. R. tracks to Sixth st	8
" Sixth to Fifth and Fourth to Third	4
" alley s. of Third to Second	4

LOCATION.	DIAM. INCHES.
Roby st., n. from Ferry 325 ft.	4
Rohns ave., Goethe to 1,283 ft. n. of n. of Mack	6
" 360 ft. s. of Chapin to 800 ft. s. of Gratiot	8
" 800 ft. s. of Gratiot to Harper	6
Rolfe pl., 22 ft. s. of n. of Mack to 770 ft. n. of same	6
Rollin st., 198 ft. w. of w. of Wesson to 336 ft. e. of e. of same	6
Romeyn st., Cavalry to Campbell	6
" Campbell to Junction	4
Rose st., Twentieth to Eighteenth	4
Rosedale ave., 16-in. main to e. line of Woodward	6
" e. line of Woodward to w. line of Oakland	4
" w. line of Oakland main	6
Rowena st., Woodward to 23 ft. e. of w. of John R.	4
" 23 ft. e. of w. of John R. to 23 ft. e. of w. of Brush	8
" 23 ft. e. of w. of Brush to Riopelle	4
" Russell to Riopelle	30
Rowland st., 24-in. main in Michigan to Grand River	8
Russell st., Larned to n. line of Congress	6
" Congress to Macomb	8
" Mullett to Watson	8
" Rowena to Brady	30
" Watson to Canfield	6
" Canfield to s. line of Hendrie	10
" s. line of Hendrie to s. line of Piquette	8
" s. line of Piquette to Alger	6
" alley e. of, Chase to Fort	4
" alley e. of, Willis to 220 ft. n. of same	4
St. Albertus pl., 22 ft. e. of Dequindre to 260 ft. w. of St. Aubin	4
" 260 ft. w. of to St. Aubin	3
St. Antoine st., Atwater to Congress	8
" Congress to s. line of Champlain	6
" crossing Champlain	8
" n. line Champlain to n. line of Gratiot	6
" Jefferson to Congress	4
" Catherine to Elizabeth	12
" Elizabeth to Adelaide	6
" Adelaide to Watson	8
" Watson to n. line of Farnsworth	6
" crossing Frederick and Palmer	6
" s. line of Medbury to s. line of N. Boulevard	6
" crossing N. Boulevard s. side to 24-in. main	8
" 4 ft. s. of s. of Hamlin to n. line of same	6
" alley e. of, 19 ft. s. of n. of Alexandrine to 27 ft. n. of s. of Canfield	30
" alley e. of, 18 ft. s. of n. of Superior to 18 ft. n. of s. of Willis	6
" alley e. of, N. Boulevard to Custer	3 and 4
St. Aubin ave., Atwater to 22 ft. n. of n. of Harper	6
" 22 ft. n. of n. of Harper to Trombly	8
" Trombly to 27 ft. n. of s. of Clay	10
" Clay to 22 ft. n. of Danforth	6
" Larned to Congress	12
" Congress to Champlain	36
" alley w. of, 24 ft. n. of s. of Hancock to 6 ft. n. of s. of alley n. of Hancock	4
" alley e. of, Kirby to Palmer	4
St. Clair ave. (e. of city limits), 602 ft. s. of Jefferson to 8-in. main in Jefferson	4

LOCATION.	DIAM. INCHES.
St. Clair pl., Nineteenth to alley w. of Eighteenth	4
St. Joseph st., Russell to Riopelle	3
" e. line of Riopelle to 310 ft. e. of St. Aubin	4
" 310 ft. e. of St. Aubin to w. line of Chene	3
" crossing Chene	4
" e. line of Chene to 202 ft. e. of same	3
" 202 ft. e. of Chene to w. line of Grandy	4
" w. line of Grandy to 18 ft. e. of w. of Jos. Campau,	6
" w. line of McDougall to w. line of Collins	3 and 4
" w. line of Collins e. 188 ft.	6
St. Paul ave., Bellevue to e. line of Concord	4
" crossing Frontenac Boulevard	6
" e. line of Frontenac Boulevard to e. line of Field	4
" Townsend to 28 ft. e. of w. of Baldwin	4
" 28 ft. e. of w. of Baldwin to 3 ft. e. of e. of same	6
" Iroquois to Burns	6
" Crane to alley w. of same	4
" Holcomb to Belvidere	6
Sargent st., St. Aubin to 6 ft. e. of D., G. H. & M. R. R.	6
" crossing Collins	6
Savoy st., Twenty-fourth to Twenty-third	4
" Twenty-second to Twenty-first	4
Scheffer pl., 6 ft. e. of w. of alley e. of Collins to 21 ft. e. of w. of Moran	6
Schiller st., e. from McClellan 245 ft.	4
Schiller Boulevard (n. and s. sides), at w. line of Woodward 8 ft.	4
Schneider pl., e. from Ellery 105 ft.	6
" 105 ft. e. of Ellery to Mt. Elliott	4
Scott st., Riopelle to e. line of St. Aubin	4
" e. line of St. Aubin to Dubois	3
" crossing Dubois to 156 ft. e. of same	4
" 156 ft. e. of Dubois to 499 ft. e. of Chene	3
" 499 ft. e. of Chene to Jos. Campau	4
" Orleans to Chene	30
Scotten ave., Fort to Dix	6
" Dix to Buchanan (s.)	8
" Buchanan (s.) to Buchanan (n.)	16
" Buchanan to McGraw	6
" 245 ft. s. of s. of Moore pl. to 14 ft. s. of n. of same	6
Scovel pl., crossing W. Boulevard to 24 ft. e. of same	6
" 25 ft. w. of e. of Twenty-sixth to 203 ft. e. of same	6
" in mound "Eckstrom" 50 ft.	4
Sears ave., Holcomb to 193 ft. e. of McClellan	4
" 193 ft. e. of McClellan to 555 ft. e. of same	6
Second st., Front to Woodbridge	6
" Woodbridge to alley n. of Jefferson	10
" crossing Congress	10
" Abbott to alley s. of same	8
" Abbott to Grand River	10
" alley w. of, Front to alley n. of same	4
" alley w. of, alley s. of to Lewis	4
Second ave., High to 166 ft. n. of Henry	4
" Grand River to Bagg	10
" Bagg to s. line of Canfield	6
" crossing Canfield s. line to 20 ft. s. of n.	8
" 20 ft. s. of n. to 30 ft. n. of Prentiss	6
" (e. side) 16 ft. s. of n. of Forest to 17 ft. s. of n. of Hancock	6

LOCATION.	DIAM. INCHES.
Second ave., crossing Forest s. line to 22 ft. n. of n. line	6
" (e. side) crossing Putnam and Merrick	6
" (w. side) crossing Putnam and Merrick	4
" 36 ft. s. of n. of Kirby to 2 ft. n. of n. of Colburn	6
" 24 ft. s. of n. of Colburn to s. line of N. Boulevard	6
" crossing N. Boulevard	8
" s. line of Bethune to 1 ft. s. of n. of same	6
" 3 ft. s. of s. of Hazelwood to 1 ft. s. of n. of same	6
" alley w. of Forest to 28 ft. n. of s. of Merrick	6
" alley e. of, alley n. of Canfield to Prentis	4
" alley e. of, 28 ft. n. of s. of Warren to 16 ft. n. of s. of Putnam	6
Secor pl., from Ferry to 267 ft. s. of s	4
Selden ave., alley e. of Trumbull to Third	8
" Third to Second	4
" Second to Cass	6
" Cass to Woodward	4
" alley s. of, Greenwood to alley w. of Fourth	4
Seminole ave., 21 ft. s. of n. of Agnes to n. line of St. Paul	6
" alley e. of 6 ft. n. of s. of alley n. of Jefferson to n. line of Champlain	4
" alley e. of n. line of Champlain to 21 ft. s. of n. of Agnes	6
Seventh st., River st. to alley n. of Lafayette	8
" alley n. of Lafayette to Bagg	10
" Bagg to Grand River	8
" Grand River to Calumet	6
" crossing Calumet s. to n. line	8
" n. line of Calumet to 684 ft. n. of Stanley	6
" alley w. of, alley s. of to Spruce	3
" alley w. of, alley s. of to Perry	4
Seventeenth st., Fort to Poplar	6
" Poplar to s. line of Buchanan	4
" s. line of Buchanan to Warren	6
Seward ave., 184 ft. w. of Hamilton Boulevard to Woodward	6
Seyburn ave., Jefferson to n. line of Agnes	6
" 585 ft. s. of to Gratiot	6
Shady lane, crossing W. Boulevard	4
" crossing Vinewood	6
Shakespeare Boulevard (n. and s. sides) at w. line of Woodward 9 ft	4
Shelby st., Atwater to Woodbridge	6
" Woodbridge crossing n. side	8
" n. line of Woodbridge to Michigan	10
" Lafayette to alley s. of Michigan	4
Sheridan ave., Jefferson to 35 ft. s. of n. of Waterloo	6
" Mack to Gratiot	6
" Gratiot to 18 ft. n. of Ferry	8
Sherman st., Hastings to Elmwood	4
" Russell to Orleans	8
" crossing Jos. Campau w. to e. line	6
Shipherd ave., Champlain to 221 ft. n. of n. of same	6
" n. from Florene 169 ft	6
Sibley st., Clifford to Woodward	6
Sidney ave., 16-in. main in Woodward to Oakland	6
" Russell to 779 ft. e. of	4

LOCATION.	DIAM. INCHES.
Sixth st., River st. to Congress	16
" Congress to Abbott	24
" River st. to alley n. of	4
" Abbott to Cherry	6
" Cherry to 47 ft. s. of Bagg	12
" 47 ft. s. of Bagg to 24-in. main	16
" n. from Bagg to Grand River	8
" Grand River to 473 ft. n. of	4
" 473 ft. n. of Grand River to Calumet	6
" crossing Calumet	8
" n. line of to 20 ft. n. of Calumet	6
" 20 ft. n. of n. of Calumet to 265 ft. n. of Lysander	4
" 265 ft. n. of Lysander to 27 ft. n. of s. of Forest	6
Sixteenth st., Lafayette to Myrtle	6
" Myrtle to Buchanan	8
" Buchanan to Grand River	10
" Grand River to McGraw	8
" s. from 24-in. main in N. Boulevard 63 ft	8
" alley w. of, Lafayette to Howard	3
Smith ave., Woodward to 3 ft. w. of w. of Oakland	4
" 3 ft. w. of w. of to 25 ft. e. of w. of Oakland	6
South st., Grand River to Noble	4
Southern ave., Livernois to 152 ft. e. of same	4
Spencer st., Second to Cass	4
" alley s. of alley e. of Second to First	4
" alley s. of, e. of First to Cass	4
Sproat st., Cass to Woodward	4
Spruce st., Thirteenth to Twelfth	6
" Twelfth to Harrison	4
" National to alley w. of Trumbull	4
" alley w. of to Seventh	3
" Seventh to Fifth	4
" alley s. of, from second alley w. of, to first alley w. of Seventh	3
Standish st., Twentieth to Foundry	6
Stanley ave., Tillman to Williams	6
" 21 ft. w. of e. of Williams to Maybury	8
" Grand River to Sullivan	6
" crossing Humboldt w. side	4
" 25 ft. w. of e. of Humboldt to 2 ft. e. of e. of Eighteenth	6
" Stanton to Sixteenth	6
" crossing Fourteenth	6
" 183 ft. w. of to Twelfth	4
" Commonwealth to Seventh	4
" Seventh to Greenwood	6
Stanton ave., Merrick to Antoinette	6
" crossing N. Boulevard	6
Stark ave., Livernois to Welch	4
State st., Cass to Woodward	10
" crossing Washington e. side 24 ft.	24
" 80 ft. w. of e. of Washington to Woodward	30
" alley s. of, from Cass to alley w. of Washington	4
" alley s. of, from alley e. of Washington to e. line of Griswold	4
" alley s. of, e. line of Griswold to alley w. of Woodward	8
Stevens ave., 26 ft. n. of s. of Gratiot to 366 ft. n. of same	6

LOCATION.	DIAM. INCHES.
Stimson pl., 18 ft. w. of e. of Cass to 29 ft. e. of w. of Woodward...	12
" 29 ft. e. of w. of Woodward to 7 ft. w. of e. of same....	16
Stewart st., Bellevue to Canton	6
Sullivan ave., Michigan to 11 ft. s. of s. of D. & B. C. R. R.	6
" crossing Warren	6
" 14 ft. s. of n. of Putnam to 24 ft. s. of n. of Merrick..	6
" 36 ft. e. of w. of Grand River to 25 ft. s. of n. of Milwaukee	6
" crossing N. Boulevard	8
Summit ave., River st. to Fort	6
Superior st., crossing Brush	4
" 3 ft. e. of e. of Brush to 220 ft. w. of Beaubien	6
" 220 ft. w. of to Beaubien	4
" Beaubien to Russell	6
" Riopelle to Dequindre	4
" Dequindre to St. Aubin	6
" crossing e. side of St. Aubin	4
" St. Aubin to w. line of Dubois	3
" w. to e. line of Dubois	6
" e. line of Dubois to w. line of Chene	3
" crossing Chene	4
" e. line of to 343 ft. e. of Chene	3
" 343 ft. e. of Chene to Mitchell	4
" McDougall to Gratiot	4
Swain ave., 40 ft. s. of Wabash R. R. to Fort	6
Sycamore st., Wabash to Harrison	4
" National to alley w. of Trumbull	4
" 123 ft. w. of to Grand River	6
Sylvan st., Vinewood to 65 ft. e. of same	4
" 65 ft. e. of Vinewood to 105 ft. w. of Twenty-seventh..	6
" 105 ft. w. of to Twenty-seventh	4
Sylvester st., Gratiot to Mt. Elliott	4
" Beaufait to 23 ft. e. of w. of Concord	4
" 23 ft. e. of w. Concord to 32 ft. e. of w. of same	6
Taylor ave., 2 ft. w. of e. of Hamilton Boulevard to 16-in. main in Woodward	6
Tenth st., River st. to Abbott	8
" Abbott to Michigan	24
Theodore st., John R. to w. line of Riopelle	4
" w. to e. line of Riopelle	6
" e. line of Riopelle to 106 ft. e. of same	4
" 268 ft. w. of St. Aubin to w. line of Dubois	4
" crossing Dubois	6
" e. line of Dubois to Grandy	4
" 11 ft. e. of w. of Jos. Campau to 27 ft. w. of e. of McDougall	6
" crossing Collins	6
" crossing Moran w. side	6
" e. from Moran 375 ft	4
" crossing Mt. Elliott main to main	6
" 15 ft. w. of e. of Mt. Elliott to w. line of Beaufait....	4
" Helen to 229 ft. e. of e. of same	6
" alley s. of, e. and w. of Davis pl. 150 ft	4
Third st., Front to s. line of River st	6
" s. line of River st. to Larned	8
" Larned to alley n. of	6
" Larned to Fort st	24
" Abbott to High	6
" alley e. of, alley n. of, Michigan to Lewis	4

LOCATION.	DIAM. INCHES.
Third ave., Grand River to Bagg	8
" Bagg to Pitcher	6
" 48 ft. n. of s. of Pitcher to 21 ft. s. of n. of Selden	10
" 21 ft. s. of n. of Selden to s. line of Calumet	6
" s. to n. line of Calumet	8
" n. line of Calumet to n. line of Holden	6
" crossing Baltimore	6
" s. line of Bethune to 1 ft. s. of n. of same	6
" crossing Blaine	6
" Calumet to Canfield	30
" alley e. of Henry to Brainard	4
Thirteenth st., River st. to Fort	4
" Fort to Howard	6
" alley s. of Porter to Porter	4
" Porter to Ash	6
" crossing Myrtle	6
" Magnolia to n. line of Grand River	6
" n. line of Grand River to 15 ft. n. of Canfield	4
" 15 ft. n. of Canfield to Hancock	6
" Hancock to 150 ft. n. of	4
" 150 ft. n. of Hancock to 20 ft. n. of s. of Kirby	6
" 25 ft. n. of s. of Harper to 210 ft. n. of n. of same	6
" alley w. of, Bagg to Myrtle	6
Thirtieth st., 30 ft. s. of Jackson to Buchanan	6
" Devereaux to 153 ft. s. of Warren	6
Thirty-first st., Michigan to 250 ft. s. of Warren	6
" 150 ft. s. of to Norton	6
Thirty-second st., Michigan to 15 ft. s. of Buchanan	4
" 15 ft. s. of to 85 ft. n. of Buchanan	6
" 85 ft. n. of to 385 ft. n. of Buchanan	8
" 385 ft. n. of Buchanan to 82 ft. n. of Horatio	6
Thirty-third st., Michigan to Horatio	6
Thirty-fourth st., Michigan to 136 ft. n. of Jackson	8
" 136 ft. n. of Jackson to 64 ft. s. of Buchanan	6
" 64 ft. s. of to 132 ft. n. of Buchanan	8
" 132 ft. n. of Buchanan to 126 ft. n. of Rich	6
Thirty-fifth st., Michigan to n. line of Buchanan	6
" n. line of Buchanan to 277 ft. n. of n. of Rich	8
Thompson ct., n. of Forest 115 ft	4
Tillman ave., Michigan to 300 ft. n. of Merrick	6
" Hudson to McGraw	6
Toledo ave., Livernois to McKinstry	6
" McKinstry to 360 ft. e. of Scotten	4
" 360 ft. e. of Scotten to Vinewood	6
" w. line of W. Boulevard to Twenty-fifth	6
Tonti st., Van Dyke to Maxwell	6
Torrey st., Twenty-eighth to Lovett	4
" crossing w. side of Scotten	4
Townsend ave., Jefferson to 36 ft. n. of s. of Waterloo	6
" n. from Mack 208 ft	6
" 208 ft. n. of Mack to s. line of Gratiot	4
" s. line of, to 8-in. main in Gratiot	8
" 8-in. main in Gratiot to n. line of Palmer	6
Trombly ave., Oakland to Hastings	6
" Crystal to Russell	4
" Russell to 20 ft. e. of w. of Dubois	8
" 183 ft. w. of to Chene	6

LOCATION.	DIAM. INCHES.
Trombly ave., Chene to w. line of Collins	4
" crossing Collins	6
" e. line of Collins to 72 ft. e. of Ellery	4
" 72 ft. e. of Ellery to e. line of Mt. Elliott	6
Trowbridge ave., 16-in. main to e. line of Woodward	6
" e. line of to 511 ft. e. of Woodward	4
Trumbull ave., 21 ft. s. of n. of Fort to 9 ft. n. of s. of alley s. of Abbott	8
" 9 ft. n. of s. of alley s. of, Abbott to 24-in. main in Abbott	10
" Abbott 24-in. main to 8-in. main in Michigan	8
" Michigan to Plum	6
" Grand River to alley n. of	6
" Calumet to Forest	8
" Forest to 497 ft. n. of G. T. R. R	6
" 497 ft. n. of G. T. R. R. to 50 ft. n. of Piquette	8
" 50 ft. n. of Piquette to Holden	6
" alley w. of, 32 ft. s. of n. of Cherry to 20 ft. s. of n. of same	6
" alley w. of, 20 ft. s. of n. of Cherry to Pine	3
" alley w. of, Pine to Myrtle	4
" alley w. of, alley n. of Grand River to Calumet	6
" alley e. of, Plum to Sycamore	6
Tuscola st., Fourth to Third	6
" alley s. of, Greenwood to alley w. of Fourth	4
Tuxedo ave. (Highland Park), 13 ft. w. of e. of Hamilton Boulevard to 16 ft. w. of e. of Woodward	6
Twelfth st., 458 ft. s. of to River st	4
" 17 ft. s. of n. of River st. to 31 ft. s. of n. of Lafayette,	8
" 26 ft. s. of n. of Howard to 25 ft. s. of n. of Baker	8
" Baker to Calumet	6
" Calumet to s. line of N. Boulevard	8
" s. line of, to 16 ft. s. of n. line of, N. Boulevard	10
" alley w. of, from 121 ft. s. of to Porter	4
" private alley e. of, from 12-in. main in Porter to alley n. of	4
Twentieth st., Fort to Michigan	6
Twenty-first st., Fort to Standish	4
" crossing Porter s. to n. line	6
" alley w. of, Brevoort to Webster	4
Twenty-second st., Fort to Dalzelle	6
Twenty-third st., Fort to Magnolia	6
" Magnolia to 35 ft. s. of Linden	3
" 35 ft. s. of Linden to 100 ft. n. of Poplar	4
" 100 ft. n. of Poplar to Kirby	6
" Kirby to s. line of Hudson	4
" s. line to n. line of Hudson	6
" n. line of Hudson to s. line of McGraw	4
" s. line of McGraw to Ivy pl	6
Twenty-fourth st., River st. to Fort	4
" Fort to Baker	6
" Baker st. to s. line of Michigan	8
" s. line of to 52 ft. n. of Michigan	16
" 52 ft. n. of to 138 ft. n. of Michigan	18
" 138 ft. n. of to 192 ft. n. of Michigan	20
" 192 ft. n. of Michigan to Butternut	24
" Butternut to Buchanan	10

LOCATION.	DIAM. INCHES.
Twenty-fourth st., Buchanan to n. line of McGraw	8
" n. line of McGraw to Chope pl	6
Twenty-fifth st., Howard to Baker	4
" Baker to Toledo	6
" E. st. to Michigan	4
" Michigan to Hancock	6
" crossing Warren	6
" 190 ft. s. of s. of Merrick to 30 ft. n. of s. of same,	6
" 125 ft. s. of Hudson to n. line of McGraw	6
Twenty-sixth st., 213 ft. s. of E. st. to 146 ft. s. of Hancock	6
" 146 ft. s. of to 421 ft. n. of Hancock	8
" 421 ft. n. of Hancock to McGraw	6
" 24. ft. n. of s. of Brown pl. to 36 ft. n. of s. of Grand River	6
Twenty-seventh st., Myrtle to s. line of Buchanan	6
" crossing Buchanan	8
" n. line of Buchanan to 32 ft. n. of s. of McGraw,	6
Twenty-eighth st., Michigan to 125 ft. n. of Rich	6
Twenty-ninth st., 565 ft. s. of Michigan to Buchanan	6
Union st., Fifth to Fourth	3
Uthes st., McKinstry to Clark	4
Van Dyke ave., Jefferson to 150 ft. n. of Waterloo	8
" 276 ft. s. of n. line of to n. line of Worcester	8
" n. line of Worcester to Mack	6
" Mack to n. line of Gratiot	8
" Gratiot to Harper	6
" Jefferson connecting with 42-in. main 22 ft	10
Vincennes st., McClellan to 172 ft. e. of e. of same	6
Vine st., crossing e. side of Fifth	4
" Fifth to Fourth	3
Vinewood ave., Fort to Buchanan	24
" Buchanan to Merrick	10
" Merrick to Grand River	8
" Fort to 430 ft. n. of Toledo	6
" F. st. to Buchanan	6
" crossing Vinewood s. of M. C. R. R. between mains 22 ft.	6
Virginia ave. (both sides), Hamilton Boulevard to w. line of Woodward	4
" 5 ft. e. of w. line of to 16-in. main in Woodward	6
Visger st., Twenty-eighth to Lovett	6
" crossing e. side of Scotten	6
" La Salle to Vinewood	6
Wabash ave., n. line of M. C. R. R. to n. line of Ottawa	6
" n. line of Ottawa to s. line of Buchanan	4
" s. line of Buchanan to s. line of Grand River	8
" crossing Grand River	6
" n. line of Grand River to 18 ft. s. of s. line of L. S. & M. S. R. R.	8
" 18 ft. s. of s. of L. S. & M. S. R. R. to 186 ft. n. of Piquette	6
" crossing N. Boulevard	6
Walbridge st., Baldwin to Van Dyke	6
Walker st., Atwater to Jefferson	4
Walnut st., 325 ft. w. of to Van Dyke	6
Warren ave., w. line of Scotten to Grand River	6
" Sixteenth to Fourteenth	4

LOCATION.	DIAM. INCHES.
Warren ave., 35 ft. e. of w. of Fourteenth to 7 ft. e. of e. of alley e. of same	6
" 7 ft. e. of e. of alley e. of Fourteenth to Avery	4
" (n. side) 195 ft. w. of to Twelfth	4
" Trumbull to 106 ft. w. of Seventh	6
" 106 ft. w. of Seventh to Greenwood	4
" Greenwood to Third	6
" Third to Cass	8
" 6 ft. e. of w. of Cass to 105 ft. e. of Riopelle	4
" Warren ct. to w. line of Dubois	4
" crossing Dubois 56 ft	6
" e. line of Dubois to e. line of Grandy	4
" 12 ft. e. of w. of to 10 ft. w. of e. of Jos. Campau	6
" crossing Collins	6
" w. line of Moran to 63 ft. e. of Dettloff ct	6
" 2 ft. e. of w. of Mt. Elliott to 178 ft. e. of e. of same	6
" Helen to 228 ft. e. of same	4
" alley s. of, 10 ft. e. of w. of Warren ct. to 6 ft. e. of w. of alley w. of St. Aubin	4
Warren ct., 6 ft. n. of s. of alley n. of Hancock to 56 ft. n. of Warren	4
Warsaw pl., 17 ft. e. of Dequindre to St. Aubin	6
Washington ave., Michigan to State	30
" Michigan to Park	10
" alley w. of, from alley s. of State to alley s. of Bagley	4
" alley e. of, from alley s. of State to alley w. of Woodward	4
Waterloo st., Dequindre to Jos. Campau	4
" Jos. Campau to Burlage pl.	6
" Burlage to Mt. Elliott	8
" Mt. Elliott to 56 ft. e. of Beaufait	4
" 56 ft. e. of Beaufait to Bellevue	6
" Field to Sheridan	6
" Townsend to Baldwin	6
Watson st., Woodward to Brush	4
" Brush to Reservoir	24
" Dequindre to Chene	4
Wayne st., 173 ft. s. of to Woodbridge	4
" Woodbridge to Michigan	6
Webster pl., Twenty-second to alley e. of same	6
" Nineteenth to alley w. of Eighteenth	4
Webb ave., e. line of Hamilton Boulevard to w. line of Woodward	4
" w. line of Woodward to 16-in. main	6
Welch ave., Plumer to s. line of M. C. R. R.	6
" 211 ft. s. of to 309 ft. n. of Stark	6
" s. line of Ingersoll to n. line of city limits	6
Wesson ave., Toledo to Leavitt	6
" M. C. R. R. to 260 ft. n. of Herbert	6
W. Boulevard (both sides), Fort to Shady lane	4
" (west driveway), Shady lane to Baker	3
" (w. side), 18 ft. s. of n. of Shady lane to 33 ft. s. of n. of Baker	4
" (w. side), n. line of Dix to n. line of Toledo	4
" (w. side), E. st. to 444 ft. s. of Michigan	6
" (w. side) 444 ft. s. of to s. line of Michigan	4
" (w. side), s. line of Michigan to Myrtle	6

LOCATION.	DIAM. INCHES.
W. Boulevard (e. side) 19 ft. s. of n. of Shady lane to 196 ft. n. of Toledo	6
West End ave. (w. of city limits), 24 ft. n. of s. of River road to 172 ft. n. of n. of Frederick 876 ft.	4
Western Hay Market, 171 ft. w. of to Trumbull	3
Westminster ave., 16-in. main to 1,222 ft. e. of Woodward	6
Whipple st., Baldwin to Van Dyke	4
Whiting ave., Jos. Campau to 1,880 ft. e. of same	4
Widman pl., Harper to Milwaukee	6
Wight st., Chene to McDougall	4
“ McDougall to w. line of Mt. Elliott	10
“ w. line of Mt. Elliott to 110 ft. e. of Meldrum	6
“ alley s. of, from McDougall to 230 ft. e. of same	4
Wilcox st., Woodward to Miami	12
Wilkins st., Brush to Russell	4
“ 158 ft. w. of Riopelle to Orleans	4
“ Orleans to 30-in. main in Chene	8
Willard st., Van Dyke to 255 ft. e. of same	4
Williams ave., Michigan to Hancock	6
“ crossing Warren	6
“ Merrick to McGraw	6
Willis ave., crossing e. side of Twelfth	4
“ e. line of Twelfth to Avery	6
“ Eighth to Sixth	4
“ Greenwood to Fourth	4
“ Fourth to Woodward	6
“ Woodward to Beaubien	4
“ Beaubien to St. Antoine	3
“ St. Antoine to Hastings	6
“ Hastings to 356 ft. e. of same	4
“ 356 ft. e. of Hastings to Rivard	3
“ Rivard to Russell	6
“ Russell to e. line of Chene	4
“ e. line of Chene to Grandy	3
“ Jos. Campau to Collins	6
“ Collins to 162 ft. e. of same	4
“ 162 ft. e. of Collins to Moran st. main	6
“ from main in Moran to alley w. of Mt. Elliott	4
“ alley s. of, from 20 ft. n. of s. of Willis to alley w. of Avery	4
Winder st., Woodward to w. line of Beaubien	4
“ crossing Beaubien	6
“ e. line of Beaubien to 30 ft. w. of e. of Hastings	4
“ 30 ft. w. of e. of Hastings to w. line of Rivard	6
“ w. line of Rivard to Orleans	4
Wing pl., Nineteenth to alley w. of Eighteenth	4
Winslow ave., Grand River to 85 ft. n. of same	4
“ 85 ft. n. of Grand River to McGraw	6
Winter st., Dequindre to 431 ft. e. of same	4
Witherell st., Woodward to Miami	16
“ Woodward to Miami	6
“ Miami to Adams	4
“ Adams to alley s. of Elizabeth	3
“ alley s. of Elizabeth to Columbia	6
Wolff st., Scotten to 357 ft. e. of same	4
Woodbridge st., Second to First	6
“ First to Griswold	4
“ Griswold to 24 ft. e. of w. of Woodward	6

	LOCATION.	DIAM. INCHES.
Woodbridge st.,	24 ft. e. of w. of Woodward to 6 ft. e. of e. line of St. Antoine	8
"	6 ft. e. of e. line of St. Antoine to Dubois	6
"	300 ft. w. of to Jos. Campau	6
"	Jos. Campau to 400 ft. e. of same	4
"	400 ft. e. of Jos. Campau to McDougall	6
"	325 ft. w. of to Leib	4
"	alley s. of, Bates to Randolph	4
"	alley s. of, Brush to 210 ft. e. of Beaubien	4
"	alley s. of, McDougall to Walker	4
Woodland ave.,	16-in. main to e. line of Woodward	6
"	e. line to 780 ft. e. of Woodward	4
Woodward ave.,	(e. side) 246 ft. s. of to Atwater	3
"	(e. side), 27 ft. s. of n. of Erskine to 25 ft. n. of s. of Stimson	16
"	(e. side) Milwaukee to 102 ft. s. of N. Boulevard,	6
"	(e. side) 102 ft. s. of to N. Boulevard	4
"	(e. side) crossing s. side of Melbourne	6
"	(e. side) crossing Chicago Boulevard	6
"	(e. side) crossing Boston Boulevard	6
"	(w. side) from 171 ft. s. of to Atwater	4
"	(w. side) crossing Virginia ave.	6
"	(w. side) crossing Shakespeare Boulevard	6
"	(w. side) crossing Schiller Boulevard	6
"	Atwater to Jefferson	16
"	Jefferson to Soldiers' Monument	24
"	Bagg to Edmund	24
"	Atwater to Adams	8
"	Adams to Baltimore	10
"	Baltimore to Clay	8
"	N. Boulevard to Woodland	16
"	Woodland to 15 ft. n. of city limits	12
"	High to 200 ft. n. of Canfield	4
"	(Highland Park) 15 ft. n. of city limits to 45 ft. n. of same	6
"	(Highland Park) 45 ft. n. of city limits to 14 ft. s. of n. of Monterey	16
"	(Highland Park) 14 ft. s. of n. of Monterey to n. line of Gerald	12
"	(Highland Park) n. line of Gerald to n. line of Moss	10
"	alley e. of, alley s. of Atwater to alley s. of Jefferson	4
"	alley e. of, alley s. of Larned to alley s. of Cadillac Square	4
"	alley e. of alley s. of to Gratiot	6
"	alley e. of Gratiot to 12 ft. s. of n. of John R.	8
"	alley e. of, 12 ft. s. of n. of John R. to 172 ft. s. of Witherell	6
"	alley e. of (private alley) 80 ft. s. of to Witherell 97 ft.	3
"	alley e. of, alley s. of Elizabeth to s. line of Elizabeth	3
"	alley e. of, crossing s. side of Elizabeth	4
"	alley e. of, Elizabeth to Columbia	6
"	alley e. of, Columbia to Montcalm	4
"	alley w. of, Atwater to alley s. of Jefferson	4

LOCATION.	DIAM, INCHES.
Woodward ave., alley w. of, alley s. of Larned to alley s. of Fort,	8
" alley w. of, alley s. of State to Clifford	8
" alley w. of, crossing n. side of Clifford	6
" alley w. of, n. line of Clifford to alley s. of Park	4
" alley w. of, Montcalm to High	3
Woodward ave. terrace, Woodward to w. line of John R	4
Wreford pl., crossing w. side of Vinewood	6
" crossing Hubbard Boulevard	6
Wreford ave., Grand River to Eighteenth	4
Zender pl., Ellery to 288 ft. e. of same	6
" 288 ft. e. of Ellery to Mt. Elliott	4

Respectfully submitted,
HENRY BRIDGE,
Supt. of Extension.

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40th
Annual
Report
for the year
1891

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FORTIETH ANNUAL REPORT

OF THE

Board of Water Commissioners

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1891.

DETROIT:
THE DETROIT FREE PRESS PRINTING COMPANY.
1892.

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BOARD OF WATER COMMISSIONERS,

DETROIT, 1892.

MEMBERS:

JOSEPH L. HUDSON, 1892.
AUGUST GOEBEL, 1894.
SAMUEL G. CASKEY, 1893.
HENRY M. DUFFIELD, 1895.
*FRANK E. KIRBY, 1896.

*John Pridgeon term expired and Frank E. Kirby was appointed to fill vacancy.

COMMITTEES:

Ways and Means	Commissioners KIRBY, CASKEY.
Extension and Construction	Commissioners CASKEY, HUDSON.
Pumping Works	Commissioners GOEBEL, KIRBY.
Supplies	Commissioners HUDSON, GOEBEL.

OFFICERS:

President	HENRY M. DUFFIELD.
Vice-President	AUGUST GOEBEL.
Secretary	L. N. CASE.
Supt. of Extension and Construction	HENRY BRIDGE.
Supt. of Meters and Inspection	THOMAS R. PUTNAM.
Supt. of Grounds	E. A. SCRIBNER.
Chief Engineer	JOHN E. EDWARDS.
Assistant Engineer	URIAH GOULD.
Meter Clerk	HARRY S. STARKEY.
Assessors and Collectors	MAX F. GREUNER. ALBERT W. GOODSELL. ANTHONY T. McLOGAN. FRED. H. HUTAFF. HARRY L. JAMES. AUGUST GOEBEL, Jr. JNO. J. ROBINSON. PETER S. BECKER.
Receiving Clerk	GEORGE E. KUNZE.
Permit Clerk	ARTHUR STORM.

DETROIT WATER WORKS.

METER RATES.

First 3,000 Cubic feet, each month, each 100 gallons	⅔ of a cent.
All over, each 100 gallons	⅓ of a cent.
Minimum rate, per annum	$9 00

ASSESSMENT RATES.

From July 1st, 1886.

	PER ANNUM
For Family, household purposes	$5 00
Green Houses.—Special rates.	
Private Stables, for each horse	2 00
Livery Stables, " " "	2 00
Dray and Team Horses, each	1 00
Cows, each	1 00
Stores and Offices	$2 00 to 20 00
Bakeries, average daily use, for each barrel of flour	3 50
Saloons, Groceries and Provision Stores, from	$3 00 to 100 00
Bar, with faucet, from	8 00 to 50 00
Fish Houses	10 00 to 100 00
Slaughter Houses.—Special rates.	
Hotels and Taverns, in addition to family rate, each room	1 00
Boarding Schools, each room	1 00
Public Schools, from	$5 00 to 50 00
Building Purposes, each 1 M brick	5
" " " 100 yards plastering	10
" " " perch stone	1½
Printing Offices, Special rates.	
Butcher Stalls, each not less than	3 00
Workshops, for 10 persons or under	3 00
" for each additional 10 persons	1 00
Estimated quantities of water each 100 gallons	2
Boarding Houses, in addition to family rate, each boarder	1 00

FIXTURES.

Bath Tubs, for families, 1st tub, $2.00; each additional	$1 00
Bath Tubs, public, each tub	5 00
Water-closets, for a family, 1st closet, $3.00; each additional, $2 00,	$3 00 to 15 00
Water-closets, for Hotels, Stores, Factories, etc., for 10 persons, $5.00; each additional person	25
Rod Water-closets, not less than	6 00
Urinals, not less than	2 00
Wash-Hand Basins, for family	$1 00 to 3 00
" " " for other purposes, each person	25
Permanent Wash Tubs	2 00
Hose, for street and lawn sprinkling	no charge.
" for other purposes, minimum charge	3 00
Fountains	$5 00 to 20 00
Street Sprinklers, each wagon	200 00

Where there is a waste of water a proper increase of rates will be made.

REPORT OF THE COMMISSIONERS.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

WATER COMMISSIONERS' OFFICE.

DETROIT, January 19, 1892.

To the Common Council of the City of Detroit:

The Board of Water Commissioners respectfully submits its annual report for the year ending December 31, 1891.

A detailed statement has already been presented by the Secretary to your honorable body, showing the entire expenditures of the Board during the year. This statement gives the number of the voucher upon which the payment is made, the name or names of those to whom it is paid, the service or material paid for, and the payment itself.

The bonded indebtedness of the Board is $1,229,000, upon which is an annual interest of $76,610.

One hundred and forty-six thousand dollars of these bonds will fall due August 1, 1893, and there will be in the sinking fund at that time about $75,000, the accumulated surplus from the general tax levy, to assist in their redemption, leaving only $71,000 to be taken from the general fund.

The total expenditures of the Board were $508,255.20, and the receipts were $492,457.45, an excess of the former over the latter of $15,797.75.

During the last two years the Board have been called upon to expend a much larger sum than is usual in the extension of its pipeage system.

In 1890, the Board, as already reported, laid a considerable amount of its larger sized supply mains throughout the central and business portions of the city.

During the past year, the large annex to the city caused the laying of pipe through much of this new territory, the laying of a large supply main up Collins from Fremont street to the Boulevard, thence west to Grand River avenue; also a large main out Woodward to the new city limits. The expense for iron pipe alone the last two years was $538,270.43.

The expense during the ensuing year in this direction will by no means be as great. The total amount of pipe laid during the year was over 43 miles, double that of any previous year, excepting that of 1890, when it was over 25 miles.

During the year the Board determined to discontinue the use of the settling basin at the pumping works, long enough at least to pump the water therefrom and inspect its condition.

As soon as the water was drawn out, the entire Board visited the works and carefully inspected the basin, and the character and quantity of the deposits that had accumulated therein.

Much to the surprise of the Board there was nothing there of an offensive nature, or that indicated any appreciable accumulation of organic matter.

It had served, however, a valuable purpose in causing the precipitation of earth or sand, of which there was an accumulation of about one and one-half feet, since its construction fifteen years ago.

It also causes the precipitation of grass or weeds that is carried along in the water, and which during the year is constantly being raked up and carried away by men employed for that purpose.

The water was ordered to be let into the basin again and the Superintendent of Construction instructed to submit to the Board, at some future day, some simple and practicable plan for a permanent renewal of the west wall of the basin and the dock along the same, which is now in a very dilapidated condition.

During the past year the Board has had, what is called "Inlet pipe No. 1," taken up, relaid, and extended 500 feet further into the river. A conduit of brick, 200 feet in length, was built from the basin to connect with this inlet pipe.

The cost of the former work was $11,020.47, and that of the latter $9,524.39.

During the past year the Board deemed it advisable, thinking it could reduce its income to that extent, to remove the assessments on hose used for street and lawn sprinkling. The total assessments on hose, then upon the books, amounted to $20,000.

The result was that a great many purchased and used hose that had not done so before, and those who already had hose seemed to use them more lavishly than ever before. Eight million gallons of water was pumped on an average each day into the city to supply this use alone, some days or portions of days, the engines were pumping at the rate of between fifty and sixty million gallons of water, the extreme limit of our capacity to supply.

The Secretary recommends that certain restrictions be made that will prevent such extravagant use, and it may be advisable to adopt something of this nature, rather than enter into a large expense to increase our pumping facilities, as urged by the Engineer, simply to supply this demand and no other, as the total quantity pumped each year is steadily and surely decreasing.

There has been quite recently considerable discussion in the papers and among manufacturers and business men, in regard to the water rates of the Board, and considerable feeling has been displayed, and wrong impressions created in this discussion.

In the first place there seemed to be a lamentable ignorance as to what the rates for water really were, and some of our manufacturers have denounced the rates as oppressive, and cited in proof thereof that the excessive charges for water had forced them to go to considerable expense to put in a plant of their own rather than submit to the burden imposed upon them.

Each of these cases took place at a time when the rates of the Board were *three times larger* than they are to-day, and yet no indication was given of any approval or even knowledge of such a large reduction, and yet which should have been a matter of common information.

It was frequently charged that water rates were less in Chicago, Toledo, Cleveland, Philadelphia and Baltimore, when in fact every one of the foregoing cities charges at least double and some three and four times as much as the rates in Detroit.

We instructed our Secretary to procure the rates of all the prominent cities and have them published in the daily papers, which was done, and which had the effect of stopping almost entirely this unreasonable hue and cry.

In our report to your honorable body, written two years ago, these words were used: "*The Board have carefully considered the subject of meter rates, and being impressed with the idea that the manufacturing and business interests of the city, upon which we depend largely for our common prosperity, should be protected and conserved as far as it was reasonable and just, at a special meeting in September* (1889) *made a reduction of* 33⅓ *per cent. in its rates. And we desire further to say, that should it be at any time in the future demonstrated to us that a further reduction can be made, we will cheerfully and gladly comply therewith.*"

We recall these words simply to show our fellow citizens that, long before the present agitation of this subject, the Board of Water Commissioners were giving this very matter careful study, and have been aiming ever since to give to the people of Detroit, that which is demanded to-day, "*cheap water.*" And we have accomplished it too, to a certain extent; for in less than two years the water rates have been reduced to *one-third* of what they were.

Unjust and unreasonable criticism from our fellow citizens, whom we are serving, with the only compensation therefor but the hope and the wish to so execute the great trust reposed in us as to best conserve their true interests, is certainly not pleasant nor is it merited.

His Honor, the Mayor, in his annual message to your honorable body, speaks of the old fogyism of the past in connection with the fact of the laying of wooden pipe several years ago, and which your present Board is now replacing with iron. Is it not true in all other matters as well as in this, in private and public life, that in advancing along the line of thought and enterprise that the wisdom of yesterday is the old fogyism of to-day, and the wisdom of to-day will be the old fogyism of to-morrow? "The evils that men do live after them, but the good is often interred with their bones." Let us not be ungrateful to the men who have passed away, nor too critical of those labors that were undoubtedly performed with all the wisdom of their time.

His Honor, the Mayor, also says that he fears that the Board is erring some in investing so much in meters, and says that an engine of almost unlimited capacity could be purchased for the amount invested in these appliances.

If it had been a question of purchasing an engine only, your Commissioners would not have hesitated a moment.

The cost of a pumping engine is but a tithe of the expenditures required to keep pace with an ever increasing consumption and waste.

To illustrate our meaning, your attention is invited to the following statement:

YEARS.	FAMILIES SUPPLIED.	WATER PUMPED.	PER FAMILY.
1868	11,554	1,666,545,125	144,239
1878	20,603	4,345,743,330	210,927
1888	36,863	14,380,166,670	390,094
1891	43,933	12,057,261,236	273,080

The first three lines illustrate how much more rapidly consumption increases than the population, when there is an unrestricted use. The last line shows what the meters have accomplished, in not only stopping the growing percentage, but also in largely reducing it. Now let us state another fact, and that is that the cost of running the water department of any city, depends largely upon the quantity of water which the works are called upon to supply. If the supply can be reduced, so can the cost. If the cost can be reduced, so can the rates for water, and that precisely is what your Commissioners are doing to-day.

In continuation of this question of an outlay that was required in the spring of 1889, let us take a pencil and put down a few items. It was estimated at that time that the expense of another engine, another large supply main from the works to the city, which by the way is needed more than an engine, a new engine house, etc., would have cost the Board $600,000.

Now the interest upon this amount for three years would have been a necessary expense, and at 4 per cent. per annum, would have amounted to $72,000. The increased operating expenses would have been at least $30,000 more, making a total of $102,000.

Now the expense actually incurred was for meters in 1889, $13,644.41, the interest upon which for three years was $1,637.32; for meters in 1890, $30,601.68, the interest upon which for two years was $2,448.13, and for meters in 1891, $12,413.14, upon which the interest for one year would have been $496.52. The total for the three years' operations then was $4,581.97.

We have given the entire expense of this department, Superintendent and repairs included, but have not made any calculations on the depreciation of the values of the meters, neither did we make any calculations on the depreciated valuations of the construction contemplated, which would have been much more.

Now what do we have as a result of our calculations? An expense of $4,581.97 has saved an expense to the city of $102,000, and which expense ever increasing and expanding would have been fastened on us for all time to come.

In conclusion we have to say that we do not ask for blind confidence, nor do we wish to be blindly and unreasonably criticized, but we do ask our fellow citizens to judge us by the facts, and that our efforts to serve the *whole* people irrespective of class or calling be properly appreciated.

It would not be proper for us to enter into the discussion as to whether the works should be self supporting or not, that is a question to be decided by your honorable body, but that it has been so far, is a matter of pride and approval with many of our citizens, and is a condition that every other city in the United States is striving to attain.

We point to our operating expenses with a just pride, inasmuch as it has no equal, even among those cities whose facilities for obtaining water are as good as they are in Detroit.

We respectfully refer you to the accompanying reports of the Secretary and the several heads of departments.

All of which is respectfully submitted.

HENRY M. DUFFIELD,
AUGUST GOEBEL,
S. G. CASKEY,
J. L. HUDSON,
FRANK E. KIRBY,
Commissioners.

REPORT OF THE SECRETARY.

Report of the Secretary.

DETROIT, January 2d, 1892.

To the Board of Water Commissioners:

GENTLEMEN:—I have the honor to submit the Secretary's report of the general operations of the Works during the past year, as well as a complete *resume* of its financial transactions.

I have been impressed with the desire of the Board to render the Works as complete and perfect in its operations as possible, and to that end have introduced into its various departments such disciplinary regulations as seemed to me necessary.

I have also given careful heed to the various complaints that have been made to me, in regard to "short supplies" and "impure water." These complaints have been in every case thoroughly investigated, and as a result I soon became aware that certain portions of the city were supplied with a much larger head than was necessary, and certain other portions with a considerably smaller head than the mechanical and household purposes, or uses, actually required.

In order to arrive at a correct knowledge of these *heads* or pressures, I had placed, through the courtesy of the Fire Department, pressure gauges in various of their engine houses, and a record has been kept ever since of the pressures at each place every hour in the day.

These gauges in the month of July, which was the first month they were in operation, showed the following facts:

LOCATION OF GAUGE.	ELEVATION OF GRADE ABOVE RIVER.	ELEVATION OF WATER ABOVE GRADE.	TOTAL ELEVATION OF WATER.
Scotten and Michigan.......	27.60 feet.	56.35 feet.	83.95 feet.
Hubbard and Fort..........	23.80 "	62.10 "	85.90 "
Bagg and 16th..............	32.30 "	51.75 "	84.05 "
Baker and 6th...............	27.15 "	56.35 "	83.50 "
Bagley and Clifford.........	32.84 "	47.15 "	79.99 "
Jefferson and Randolph.....	31.75 "	51.75 "	83.50 "
Fort and Elmwood..........	29.36 "	43.70 "	73.06 "
Grand River and 16th.......	47.90 "	40.25 "	88.15 "
Alexandrine and Cass.......	51.65 "	35.65 "	87.30 "
Woodward and Milwaukee..	62.40 "	20.12 "	82.52 "
Russell and Ferry...........	63.75 "	32.20 "	95.95 "
Russell and High...........	50. "	36.80 "	86.80 "
Gratiot and Grandy.........	50. "	34.50 "	84.50 "

Upon making a study of this table, it will be readily seen that although the general elevation of water throughout the city is practically the same, yet the "elevation above the grade," or the second column, shows a great disparity, being all the way from 20 to 62 feet.

An equalization of the pressures throughout the city is the only important matter in this regard, and it therefore became a study how to increase the lower and decrease the higher pressures. This could be partially accomplished by the partial closing of gates in pipes leading to the districts where the pressure was unnecessarily large, and by laying a few lines of larger supply mains to such districts as had a very low pressure. This has been done to a certain extent, and while the evil has been but partially cured, yet one thing, and a very important one, has been accomplished, and that is, *not a single complaint has been made of a low pressure in the last three months.*

IMPURITIES IN THE WATER.

These have been found, upon investigation, to consist almost entirely of sand or earth, and grass, and would naturally lead to the conclusion that sedimentation, or precipitation, is not accomplished to any great extent by the use of the settling basin at the Pumping Works. This conclusion was sustained by the condition in which the basin was found on the 6th of last November, when the water was pumped out and inspected by the Board. Your honorable body has at various times considered the question of constructing a new settling basin, but have concluded not to do so, I believe, because the expense would be much greater than any good to be attained thereby. The question has occurred to me as to whether the water could not be more thoroughly strained before pumping it into the city than is now accomplished by the strainer at the ends of the inlet pipes, and in the gate wells. Soon after the pumping out of the basin I suggested to Supt. Bridge the plan of extending a strainer completely across the basin, the meshes or openings to be so fine as to force the whole surface of the strainer to be in use to allow the necessary quantity of water to pass. This would not only strain the water far more thoroughly than now, but would also accomplish more perfectly, what is sought for by the use of the bulk head, spreading the flow of water over the entire width of the basin. Mr. Bridge approved of the idea, and no doubt will recommend it to your attention.

PUMPING WORKS.

It will seen by the report of the Chief Engineer that less water was pumped than in the year previous, notwithstanding the rapid growth of the city. This indicates something of that which has been accomplished in still further reducing the waste, though not entirely. The action of the Board in removing the charge upon hose used for street and lawn sprinkling, had the effect of almost if not quite doubling the number of hose in use, and also causing a more lavish and extravagant use of the same. A comparison between the quantity pumped in November and December, and that of July and August, will give some idea of the immense quantity used for sprinkling. The average pumped in November daily was 28,755,869, and that in December 30,113,603 ; while that of July was 37,020,418, and that of August 39,141,427. It will be argued that the G. A. R. National Encampment in August largely increased the consumption, but this was not sufficient to any more than possibly increase the daily average for the month about one million. Deducting this and averaging the two months we find that there was pumped each day in July and August 8,000,000 gallons of water more than the average pumped in November and December.

While it was a sufficient sacrifice on the part of the Board to abate the charges for hose, which amounted in 1890 to $20,000, it has been called upon to make that sacrifice greater by a recommendation of the engineer to purchase another engine simply to supply the exorbitant demand in the summer months. In Mr. Edwards's report he urges upon the Board the necessity of having increased facilities for pumping, notwithstanding the fact that the whole quantity that was pumped during the year was less than it has been in the last five years.

The following statement shows the amount of water pumped during the last six years :

1886	10,576,571,254	gallons
1887	13,168,859,808	"
1888	14,380,166,670	"
1889	12,875,334,453	"
1890	12,120,944,532	"
1891	12,057,261,236	"

I consider that the generosity of the Board has been grossly abused, and I recommend that some radical restrictions be made in the use of the hose, either in regard to length of time of such use, or the time of day in which they will be permitted to be used.

I certainly am opposed to seeing the Board drawn into the expense of another engine, and which means another house, engineers, etc., when it is a fact that through the operations of the Board in stopping the waste, the work required at the pumping station is steadily *decreasing*, and has been since

1888, during which year the Board pumped over six million gallons daily more than was pumped last year.

Under the direction of the Committee on Pumping Works, I prepared the following rules for the government of the officers and men employed at the Works:

RULE I.

The Chief Engineer shall have charge of the Engine House, and all of the means and appliances constructed and used for supplying water to the city.

RULE II.

The *First*, *Second* and *Third* Assistant Engineers shall in turn, eight hours out of each twenty-four, have direct charge of the engines, boilers and other means used in pumping water, and the Engineers, firemen and other employees engaged in said work shall obey the orders of the Assistant in charge only.

All orders or instructions from the Chief Engineer must be given the men through the Assistant-in-charge, in order that there may be no confliction.

This rule not to apply in moments of extreme danger or peril when the Chief Engineer is present.

RULE III.

The Engineers and Firemen may be excused from duty in the discretion of the Chief Engineer, but the Assistants must in no case be absent from the Engine House during the hours they are in charge of the same, unless it be on a matter of grave importance to the Works, or in case of sickness to self or family.

RULE IV.

All the employees of the Pumping Works as aforesaid, with the exception of the Chief Engineer, shall give their services during the hours of the day arranged for them by the Chief Engineer. During the other hours of the day, as long as they conduct themselves in a decent lawful manner, they are independent citizens, and can do as they please, and live where they please, without reference to the Board or any of its Officers.

RULE V.

The telephone boy is employed by the Board for the sole purpose of *minding the telephone,* and such other duties as may be required of him, that will not cause him to absent himself from the vicinity of the telephone room. The Chief Engineer and the Superintendent of the grounds will keep him apprised of their locality during the hours of the day as fully as possible, in case they are called for.

RULE VI.

The Superintendent of the grounds, as such, is subject only to orders from the Board, or their Secretary, as provided for in the Regulations of the Board. In his capacity as Assistant or Clerk to the Chief Engineer, he will be subject to the instructions of that official, and perform his duties as such, as he, the Chief Engineer, may direct.

RULE VII.

The watches of the three Assistants are arranged as follows:

First Assistant,	-	from	7 A. M.	to	3 P. M.
Second "	-	"	11 P. M.	"	7 A. M.
Third "	-	"	3 P. M.	"	11 P. M.

This arrangement must not be changed without permission from the Office of the Board.

EXTENSION AND CONSTRUCTION.

As will be seen by the report of Mr. Bridge, Superintendent of this department, over 43 miles of iron pipe were laid during the past year.

The operations of the Board for the two past years in this respect, have been very extensive, making an additional pipeage of over 68 miles. The cost to the Board of the above extension was in 1890, $258,165.65, and in 1891, $280,104.78, or a total of $538,270.43.

I am very happy to state that the extensions required in the ensuing year will by no means be so large, in fact, that not over one-half the amount of pipe contracted for, for the year 1891, will be necessary for 1892.

METERS AND METER RATES.

As will be seen by Superintendent Putnam's report, about 400 additional meters have been placed during the year. The work in this department has progressed in a careful, painstaking manner, and certainly merits the full approval of the Board. The introduction of meters in this city has necessarily required the greatest care and courtesy on the part of the Superintendent of that department and the employees under him; and from the fact that but little indignation or opposition has been expressed or felt at what some considered an unnecessary innovation, there can be no doubt as to the good conduct of this work.

His report is full of interesting details, and I respectfully invite your careful attention to it.

The continual good effect of the further introduction of meters can best be understood by a close inspection of the accompanying table.

The cost of maintenance appears by this statement to be much less than the preceding year, but is really due, almost entirely, to the fact that I have eliminated from the Operating Expenses certain items that have hitherto been included therein, but which do not properly belong there. Practically, this expense was about the same as that of 1890.

COMPARATIVE STATEMENT.

	1887.	1888.	1889.	1890.	1891
Daily average consumption in gallons.	36,079,166	39,397,716	35,274,888	33,208,067	33,033,592
Daily average consumption per capita..	197	204	172	155	144
Total consumption in the year	13,168,859,808	14,380,166,670	12,875,334,453	12,120,914,532	12,057,261,236
Consumption through meters.........	....	91,750,000	139,090,000	626,944,765	1,194,842,400
Percentage of water metered.........	....	.00⅝	.01	.05⅙	.10
Revenue from unmetered water.......	$316,676.39	$335,140.00	$354,016.00	$350,599.73	$342,395.89
Revenue from metered water.........	$6,158.20	$9,175.00	$13,909.00	$37,278.00	$46,684.08
Per thousand gallons metered water...	....	....	.10	.059	.038
Per thousand gallons unmetered water.	....	....	.027	.030	.031
Number of families supplied.........	34,486	36,863	39,158	41,467	43,933
Number of service connections.......	....	31,821	37,725	40,351	43,727
Miles of distributing pipe.............	307	325	343	362	405
Number of meters, indicators, etc.....	....	48	204	866	1,239
Expense of maintenance.............	$106,613.73	$101,019.00	$102,587.00	$102,391.00	$95,591.54

On the 22d of December last, under instructions from the Board, I prepared a statement for publication in the daily papers of the city, showing the cost of water when metered, in a number of the larger cities of the United States. This statement is included herewith, and is based upon the meter rates of the several cities named, and which are on file in this office.

Buffalo being the only city which has a meter rate for manufacturers less than that of Detroit, a comparative statement of certain conditions in the two cities is also attached. By an examination of these conditions, I think it is obvious that the meter rates in Detroit of 3⅛ cents per 1,000 gallons is much cheaper than at 3 cents in Buffalo; that is as far as the respective Water Works are concerned. Buffalo has to maintain only one-ninth as many meters as Detroit, and pumps, through this one-ninth, about four times as much water as Detroit does through its larger number, making the cost of maintenance in Buffalo as compared to that of Detroit of *one* to thirty-six. Buffalo also secures from the general tax levy $25,000 more than Detroit.

COMPARATIVE SCHEDULE OF METER RATES IN DIFFERENT CITIES.

CONSUMERS.	Gallons Consumed in November.	Detroit.	Chicago, Ill.	Albion, N. Y.	Cleveland.	Albany, N. Y.	Brooklyn.	Philadelphia.	St. Paul, Minn.	Kansas City, Mo.	Providence, R. I.	New York City.	Milwaukee.	Boston.	Denver, Col.	Toledo, O.	Buffalo, N. Y.
Michigan Car Company...	3,933,000	$131 85	$317 94	$442 05	$263 70	$196 65	$393 30	$314 64	$403 30	$375 57	$606 62	$524 40	$224 43	$554 85	$350 98	$227 08	$117 99
Goebel Brewing Company,	3,083,000	106 85	249 94	357 05	213 70	154 15	308 30	246 64	316 30	299 07	479 11	416 25	171 13	465 25	297 90	187 75	92 49
Detroit Steel and Spring Works...............	2,736,000	91 95	222 18	322 35	183 90	136 80	273 60	218 88	281 60	267 84	427 06	344 81	160 96	427 17	274 02	170 40	82 08
Russell House.............	2,201,250	74 12	179 40	268 88	148 24	220 12	330 19	176 20	228 13	219 71	346 85	293 50	132 44	354 20	236 34	142 67	66 04
Hammond, Standish & Co	1,722,750	58 17	151 12	221 03	116 34	86 13	172 28	157 82	180 28	176 65	275 07	229 69	106 92	277 64	200 22	116 35	51 68
Daniel Scotten & Co.......	1,458,750	49 37	120 00	193 80	98 74	72 93	145 87	116 70	153 88	152 89	235 47	194 50	103 69	235 30	178 99	100 77	43 76
Traugott Schmidt.........	850,500	29 10	66 54	120 81	56 70	42 52	85 05	68 04	93 05	98 14	144 23	113 40	60 40	138 08	123 80	63 33	25 51
Detroit Gas-Light Comp'y,	441,000	15 45	38 58	71 57	30 90	22 05	44 10	35 28	52 10	60 70	82 80	58 80	38 54	72 89	73 55	35 97	13 23
Detroit Edge Tool Works .	282,000	10 15	25 78	52 50	20 30	14 10	28 20	22 56	36 20	43 44	56 40	37 60	30 08	47 12	49 80	24 06	8 46
Emery Wheel Works......	153,000	5 85	15 30	32 95	11 70	7 65	15 30	12 24	19 36	27 49	31 60	20 40	17 66	26 48	30 60	13 74	4 59

COMPARATIVE STATEMENT.

	DETROIT.	BUFFALO,
Number of meters January 1, 1891..............	866	94
Consumption through meters, gallons..........	626,944,765	2,236,692,300
Meter rates, per 1,000 gallons....................	3⅛ cents.	3 cents.
Total collected from meters in 1890.......... ..	$37,278.00	$67,107.69
Unmetered water, gallons	**11,498,999,767**	**14,412,895,110**
Received for same	**$350,599.73**	**$498,944.06**

	DETROIT.	BUFFALO.
Rate per 1,000 gallons for same	3 cents.	3⅛ cents.
Per capita supply, gallons, daily	155	186
Miles of pipe	362	302
Number of service connections	40,851	40,331
Received from general tax levy................	**$75,000.00**	**$100,000.00**
Operating expenses............................	**$99,243.78**	**$143,091.79**

This comparative statement is made from the reports from both cities for the year 1890, and by consulting the table upon a foregoing page it will be seen the number of meters has increased in Detroit to 1,239, and the rate received for each 1,000 gallons of metered water is three and four-fifths ($3\frac{4}{5}$) cents, and the rate for each 1,000 gallons unmetered water is three and one-tenth ($3\frac{1}{10}$) cents.

In order to show the exact saving accomplished by the introduction of meters, your attention is invited to the following tables. The first table shows the number of families in the city in the different years as shown, and the actual quantity of water pumped. By consulting the engineer's table it will be found that in the last three years it has cost $4.50 on an average to pump one million gallons of water. In the second table is given the quantities of water that would have been pumped had the uses of water continued unrestricted as formerly. These quantities are, of course, estimated, but so steadily and so systematic has been the increase in the amount pumped from year to year, that one cannot go far astray in estimating the quantity that would have been pumped under similar circumstances. According to these figures the actual money saved in pumping water alone exceeds the entire expense of purchasing and placing all the meters introduced by the Board by $15,501.

Now the only fault that can possibly be found in these figures is in the *estimated* quantity of water pumped each family, but as the ratio of increase from 1878 to 1888 was simply carried along into the next three years, it does not seem that even this can be wrong. This is in addition to the enormous amount saved in interest as given in the Commissioner's report.

Now let us aggregate the saving. First the interest on the expenditure required to extend the Works, $72,000, to which add the difference between the meters and the cost of pumping as above, $15,501, and then add to this the value of the meters in operation, on hand, tools, etc., which amounts to $50,187.49, and we have as a result of this " mistake " of the Board, the grand total, or saving of $137,688.49 in three years.

ACTUAL OPERATIONS OF THE WORKS.

YEARS.	FAMILIES ASSESSED.	WATER PUMPED.	TO EACH FAMILY.	REMARKS.
1868	11,544	1,666,545,125	144,000	
1878	20,603	4,345,743,330	210,000	Ratio increased in the ten years, 31 per cent.
1888	36,863	14,380,166,670	390,000	Ratio increased, 40 per cent.
1889	39,158	12,875,334,453	328,000	Commenced metering. Ratio decreased, 16 per cent.
1890	41,467	12,120,944,532	292,000	Ratio decreased, 10 per cent.
1891	43,933	12,057,261,236	274,000	Ratio decreased, 6 per cent.

ESTIMATED UPON SAME RATIO OF INCREASE AS PREVIOUS 10 YEARS.

YEARS.	TO EACH FAMILY.	TOTAL PUMPED.	EXCESS OVER ACTUAL AMOUNT.	WHICH AMOUNTS TO, AT $4.50 PER MILLION.	TOTAL EXPENSE FOR METERS.
1889	408,000	15,976,464,000	3,101,129,547	$13,954.00	$13,644.41
1890	426,000	18,064,942,000	5,943,997,468	26,743.00	30,601.68
1891	444,000	19,506,252,000	7,448,990,764	33,516.00	14,466.21
				$74,213.00	$58,712.30

PLUMBERS AND PLUMBING.

Upon the recommendation of Supt. Putnam and myself a resolution was adopted, by your honorable body, doing away with the practice of requiring a certificate from an examining board before a license was granted; also the issuing of two classes of licenses.

We both believe that the introduction of the above innovations has been productive of much good, but that the reasons for maintaining them longer are not commensurate with the trouble they cause, and the misunderstanding arising therefrom.

Hereafter licenses will be issued to master plumbers, as required by your regulations, to do all kinds and character of work, and their work carefully inspected, and every one held strictly in accordance with the requirements of the Board as to material and workmanship.

FINANCIAL STATEMENTS.

The *receipts* during the year have been as follows:

WATER RATES ACCOUNT:	
Rates paid	$389,079 97
PERCENTAGE ACCOUNT:	
From delinquents	6,101 58
Penalties for shutting off	860 50
CITY OF DETROIT ACCOUNT:	
General tax levy	72,528 36
INTEREST ACCOUNT:	
Deposits general fund	4,234 18
Deposits, sinking fund	757 07
REAL ESTATE ACCOUNT:	
Rents for office building	1,762 50
Rents for old pumping works	1,500 00
REPAIRING LEAKS ACCOUNT:	
Labor	45 97
SERVICE COCKS ACCOUNT:	
Stops, drilling and fines	7,507 92
IRON PIPE ACCOUNT:	
Laying pipe	3,642 68
Material and labor	3,037 70
Sale of dross	110 50
PLUMBERS' LICENSES ACCOUNT:	
Paid for licenses	560 00

Stop Cocks:	
Sale of old material	$5 75
Pumping Water Account:	
Sale of ashes	168 63
Sale of old material	12 29
Overpaid on coal	178 95
Office Account:	
Sale of old material	12 90
New Pumping Works:	
Ice privilege	100 00
Rent of slip	250 00
Total receipts	$492,457 45

The following are the *expenditures* of the Board, arranged under their different heads, as follows :

CONSTRUCTION.

Iron Pipe Account:		
Superintendency and clerks	$5,333 35	
Labor	90,507 35	
Iron pipe	152,001 43	
Specials	10,001 57	
Hauling	3,152 48	
Lumber	836 68	
Coal	190 53	
Oil	29 75	
Packing	253 39	
Office materials	62 33	
Tools and repairing of	959 99	
Lead	13,591 17	
Attorney	150 00	
Oatmeal	5 50	
Plugs	210 79	
Repairs	649 60	
Brick	285 00	
Postage and telegraphing	7 30	
Street car tickets	35 00	
Freight	4 00	
Livery	90 00	
Damages, and costs of suits for	357 96	
Wagon and harness supplies and repairs	77 92	
Feed	624 60	
Farrier	111 78	
Lead pipe, solder, etc	575 31	
		$280,104 78

Stop Cocks Account:		
Labor	$45 50	
Valves	9,307 72	
Boxes and covers	3,114 95	
Materials and repairs	249 39	
		$12,717 56
Meters Account:		
Meters and repairs	$6,511 79	
Freight and express	58 42	
Superintendency and labor	4,841 49	
Tools and repairing of	117 78	
Lumber, lead, etc	483 97	
Cartage and street car tickets	116 45	
Special castings and fittings	271 24	
Office expenses	12 00	
		$12,413 14
New Pumping Works:		
Conduit strainers	$448 13	
Flag	16 88	
Signs	4 00	
Plank Road tickets	5 00	
House repairs and materials for	189 76	
Labor new conduit	5,895 40	
Materials new conduit	1,741 74	
Gates new conduit	1,887 25	
Relaying No. 1 inlet pipe	2,500 00	
New lengths inlet pipe	4,729 40	
Repairs of inlet pipe	366 07	
		$17 783 63
Real Estate Account:		
Insurance, office building	$290 74	
Insurance, reservoir buildings	29 50	
Architect, office buildings	385 85	
Plumbing	749 56	
Tile	17 50	
Mason work	1,473 15	
New vault	410 00	
Iron work	940 20	
Carpenter work	3,129 47	
Painting	1,096 62	
Plastering	150 87	
Fixtures	82 64	
Repairs to roof	66 30	
		$8,822 40
Total constructing expenses		$331,841 51

OPERATING EXPENSES.

PUMPING WATER ACCOUNT:		
Engineers and firemen	$16,911 03	
Coal	5,203 24	
Handling coal	813 75	
Natural gas	27,862 90	
Polish	28 50	
Repairs and materials for	781 83	
Gas attachments	530 59	
Pumping out basin	792 50	
Electric light plant	308 24	
Lubricators	264 04	
Supplies—rags, waste, etc	265 26	
Supplies—tools, lamps, etc	77 20	
Freight and express	9 72	
Street car tickets	9 50	
Heater	12 00	
		$53,870 80
REPAIRING LEAKS ACCOUNT:		
Labor	$4,727 52	
Materials, tools and repairing of	233 64	
Street car tickets	205 00	
Wagon and harness supplies and repairs	296 79	
Feed	130 29	
Farrier	52 00	
Purchasing horse	150 00	
		$5,795 24
TELEPHONE ACCOUNT:		
Rent		$347 66
SERVICE COCKS ACCOUNT:		
Clerk and labor	$6,326 85	
Materials, tools and repairs of	108 76	
Service cocks	2,138 80	
Wagon and harness supplies and repairs	105 64	
Feed	79 42	
Farrier	50 00	
		$8,809 47
PERCENTAGE ACCOUNT:		
Labor	$1,456 00	
Feed	29 50	
		$1,485 50
INSPECTION ACCOUNT:		
Labor	$3,712 00	
Tools and repairs	14 20	
		$3.726 20

OFFICE ACCOUNT:

Secretary, assessors and clerks	$16,669 20	
Printing	972 30	
Advertising and subscriptions	209 69	
Watchmen and janitor	1,192 50	
Supplies—soaps, matches, etc.	128 75	
Supplies—office stationery	272 75	
Livery	60 00	
Furniture and fixtures	524 14	
Extra services	728 05	
Fuel, natural gas	347 68	
Light, electric	102 39	
Postage	98 93	
Attorney	459 00	
Expert examiners	40 00	
G. A. R. decorations	47 50	
G. A. R. plumbing	35 30	
Germicide, rent	36 00	
Counterfeit money	5 50	
Horse humane society	5 00	
Street car tickets	21 00	
Pressure gauges	101 49	
		$22,057 17
Total operating expenses		$95,591 54

HURLBUT FUND.

Librarian	$300 00	
Superintendent and labor	1,499 95	
Materials, lumber, salt, etc.	64 19	
Carp plant	46 65	
Flowers and pottery	53 19	
Tools and repairs of	57 30	
Fixtures for heating	30 47	
Garbage	5 40	
		$2,057 15

INTEREST ACCOUNT.

Interest on bonds	$78,765 00

RECAPITULATION.

Construction	$331,841 51
Operation expenses	95,591 54
Hurlbut fund	2,057 15
Interest	78,765 00
Aggregate expenditures for 1891	$508,255 20

STATEMENT.

Cash on hand, January 1, 1891	$109,833 10	
Receipts for the year	492,457 45	
		$602,290 55
Expended in 1891	$508,255 20	
Cash on hand, January 1, 1892	94,035 35	
		$602,290 55

To the Honorable the Board of Water Commissioners of the City of Detroit:

GENTLEMEN — Under instructions from the Committee on Ways and Means, we have carefully examined the books and vouchers of the Water Works from January 1 to December 31, 1891, and find them correct.

Cash on hand in office	$4,509 23
Commercial National Bank General Fund	64,920 50
Commercial National Bank Sinking Fund	24,605 62
TOTAL	$94,035 35

Respectfully submitted,

(Signed) DAVID R. PIERCE,
JOHN HOSMER,
Expert Examiners.

The following table is the report of the assessment made in May and June, for the fiscal year commencing July 1, 1891:

The total number of families found in the city was 44,932, or an increase in one year of 2,782, which is an increase in the population of the city of 14,132.

In the column showing "Increase or Decrease," it is shown that the assessments were $7,877 less than those of 1890, but in the next column it is shown that the assessments upon such places as were taken from the assessment rolls and metered, amounted to $11,300. And when it is further considered that the Board abated the rate on hose, which on the rolls of 1890 amounted in round numbers to $20,000, it will be seen that instead of being a loss there is an actual gain of $23,423.

WATER RATES.

ASSESSMENT FOR THE YEAR 1891–1892.

WARDS.	Families.			Tenements Vacant.	Increase Assessed.	Assessment.		
	Assessed.	Not Assessed.	Whole Number.			1891–92.	Increase or Decrease.	$ reduced by use of meters.
1st Dist.—								
Seventh	2,900	19	2,919	10	65	$18,714	— 267	$562
Ninth	4,408	47	4,455	13	123	25,808	— 115	337
Total	7,308	66	7,374	23	188	44,522	— 382	899
2d Dist.—								
Third	3,086	16	3,102	56	87	21,778	— 376	924
Fifth	3,496	27	3,523	74	149	21,846	— 773	931
Total	6,582	43	6,625	130	236	43,624	—1,149	1,855
3d Dist.—								
First	2,343	43	2,386	76	11	32,313	—2,917	1,532
Second	2,029	18	2,047	70	38	33,698	—6,580	3,852
Total	4,372	61	4,433	146	49	66,011	—9,497	5,384
4th Dist.—								
Fourth	2,862	2	2,864	66	149	27,208	— 998	657
Sixth	3,249	7	3,256	67	119	24,221	— 669	560
Total	6,111	9	6,120	133	268	51,429	—1,667	1,217
5th Dist.—								
Eighth	3,003	7	3,010	30	182	20,357	+ 454	45
Tenth	3,726	10	3,736	22	182	23,880	— 227	44
Total	6,729	17	6,746	52	364	44,237	+ 227	89
6th Dist.—								
Twelfth	2,799	21	2,820	14	200	17,979	+ 691	1,014
Fourteenth	1,843	105	1,948	19	255	11,118	+ 450	501
Sixteenth	1,724	329	2,053	9	460	10,392	+2,035	......
Springwells	25	......	25	......	8	390	+ 122	......
Total	6,391	455	6,846	42	923	39,879	+3,298	1,515
7th Dist.—								
Eleventh	3,034	9	3,043	9	161	18,900	+ 486	42
Thirteenth	1,955	5	1,960	8	175	12,178	+ 657	52
Fifteenth	1,451	334	1,785	23	170	9,929	+ 150	247
Total	6,440	348	6,788	40	506	41,007	+1,293	341
Aggregate	43,938	999	44,932	566	2,534	$330,709	—7,877	11,300

The following table shows the receipts for water rates during the year, arranged in districts, and giving the amounts collected upon each annual assessment.

The next to the last column shows the receipts for meter rates for the months of October, November and December only. The total receipts of meter rates during the year, were $46,684.08.

Previous to October 1, meter rates were collected by the Assessors and Collecters, each in his own district, and are included in the collected rates as shown.

On the 1st of October, the Board created the office of Meter Clerk, and al the work of collection and the keeping of the records necessary to such work, is now imposed upon that official.

The total receipts are $1,202.24 more than those of last year, notwithstanding a reduction in our meter rates and the hose abatement above referred to.

This showing is very gratifying, inasmuch as I had estimated that the reduction of the meter rates alone would be sufficient to cause the receipts for 1891 to be about the same as those of 1890.

RECEIPTS FOR WATER RATES, 1891.

YEAR.	First District.	Second District.	Third District.	Fourth District.	Fifth District.	Sixth District.	Seventh District.	Meters. Oct. 1 to Jan. 1	Aggregate.
1885-6	....	$4.00	....	....	....	....	....	....	$4.00
1886-7	....	....	....	$2.50	....	....	....	....	2.50
1887-8	$1.25	....	$8.00	5.00	$1.00	$2.50	....	....	17.75
1888-9	27.50	....	10.75	17.75	1.00	....	....	....	57.00
1889-90	64.75	21.75	34.75	55.50	79.00	22.25	$9.15	....	287.15
1890-91	24,165.38	23,874.88	42,973.93	29,032.92	24,253.36	22,018.09	21,584.76	....	187,898.32
1891-2	25,526.44	24,320 02	40,923.85	28,315 80	24,019.39	21,634.95	22,595.86	$13,476.94	200,813.25
Total	$49,785.32	$48,220.65	$83,951.28	$57,429.47	$48,353.75	$43,672.79	$44,189.77	$13,476.94	$389,079.97

Total meter rates received during the year, was $46,684.08.

The following table shows the whole history of the bonded indebtedness of the Board, in which it is seen that the total amount of bonds issued by the Board, is $1,850,000, of which $621,000 have been redeemed, leaving outstanding, $1,229,000, upon which there is an annual interest of $76,540.

None of these bonds were issued for the purpose of redeeming outstanding bonds falling due, but were paid from the net earnings of the Works, $471,000 of them having been paid since the last issue of bonds.

In August, 1893, there will fall due, $146,000, for which there will be in the sinking fund to assist in their redemption, about $75,000, leaving but $71,000 to be taken from the general fund.

WATER WORKS BONDS.

No. of Issue.	Act of	Issued.	Payable.	Amount.	Rate of Interest.	Redeemed.	Outstanding.
1st	1853	Aug. 1, 1853	Aug. 1, 1883	$100,000	7cts.	$100,000	....
"	"	" "	Aug. 1, 1878	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1873	50,000	7 "	50,000	....
2nd	1855	Aug. 1, 1855	Aug. 1, 1890	100,000	7 "	100,000	....
"	"	June 12, 1855	Aug. 1, 1885	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1880	50,000	7 "	50,000	....
3rd	1857	Aug. 1, 1858	Aug. 1, 1898	150,000	7 "	4,000	$146,000
"	"	Aug. 1, 1867	Aug. 1, 1887	100,000	7 "	100,000	....
4th	1869	Feb. 1, 1870	Feb. 1, 1900	100,000	7 "	....	100,000
5th	"	Aug. 1, 1872	Aug. 1, 1902	50,000	7 "	....	50,000
6th	"	Aug. 1, 1873	Aug. 1, 1903	50,000	7 "	....	50,000
"	1873	Feb. 1, 1874	Feb. 1, 1904	50,000	7 "	9,000	41,000
7th	1869	Aug. 1, 1874	Aug. 1, 1904	50,000	7 "	6,000	44,000
"	1873	" "	" "	200,000	7 "	....	200,000
"	"	June 1, 1875	June 1, 1905	150,000	7 "	1,000	149,000
"	"	June 1, 1876	June 1, 1906	200,000	6 "	1,000	199,000
"	"	Sept. 1, 1880	Sept. 1, 1899	100,000	4 "	....	100,000
"	"	April 1, 1881	April 1, 1897	100,000	4 "	....	100,000
"	"	Dec. 1, 1881	Dec. 1, 1896	50,000	4 "	....	50,000
				$1,850,000		$621,000	$1,229,000

NEW PUMPING WORKS.

The amount expended for the new Works to January 1, 1892, is as follows:

ITEMS.	EXPENDED PREVIOUSLY.	1891.	TOTAL.
Land........................	$35,000 00	....	**$35,000 00**
Force Mains..................	609,414 77	....	**609,414 77**
Inlet Pipes..................	76,675 87	$7,595 47	**84,271 34**
Dock, Basin and Canals........	129,409 12	....	**129,409 12**
Conduits and Conduit Wells....	63,738 00	9,972 52	**73,710 52**
Engine, Boiler and Coal Houses.	160,974 28	189 76	**161,164 04**
Stand Pipe and Tower.........	30,420 72	....	**30,420 72**
Pump Wells..................	54,221 56	....	**54,221 56**
Engines......................	265,642 24	....	**265,642 24**
Boilers......................	44,248 40	....	**44,248 40**
Engineer's House.............	7,773 14	....	**7,773 14**
Sewer........................	3,666 25	....	**3,666 25**
Grounds......................	48,494 03	2,057 15	**50,551 18**
Inspection...................	2,977 86	....	**2,977 86**
Miscellaneous................	8,730 95	25 88	**8,756 83**
	$1,541,387 19	$19,840 78	$1,561,227 **97**

The rapid growth of the city and its largely increased territory, obliged me to recommend to your honorable body the appointment of one additional Assessor and Collector, which was complied with to take effect in April next. P. J. Becker, so long in a position of trust and responsibility in the Western Union Telegraph Company, was selected by your honorable body, and will no doubt be an efficient and zealous official.

I have redistricted the city so that each Assessor will have two wards, and so arranged them that the assessment districts are, as nearly as possible, alike, as far as the work to be performed, is concerned.

They are arranged as follows:

District No 1—9th and 15th Wards	....	P. J. Becker
" " 2—11th and 13th "	....	H. L. James
" " 3—1st and 7th "	....	A. Goebel, Jr.
" " 4—3d and 5th "	....	Max Greuner
" " 5—2d and 6th "	....	Jno. Robinson
" " 6—10th and 14th "	....	F. Hutaff
" " 7—4th and 12th "	....	A. W. Goodsell
" " 8—8th and 16th "	....	A. T. McLogan

VALUATION OF THE WORKS.

The following is an inventory of the properties of the Board, as invoiced by the several heads of departments.

The valuations placed upon the real estate are those of W. S. Green, executor of the W. B. Wesson estate, whose opinion of real estate values is considered the best to be had.

RECAPITULATION.

Office building and lot	$60,000 00	
Three lots part of Orleans street	41,250 00	
Reservoir grounds and improvements thereon.	47,200 00	
Grounds at the new pumping works	250,000 00	
Buildings, docks, basin, conduits, etc	752,417 24	
Water pipe laid and in use	2,862,809 98	
Meters placed and in use	50,187 49	
		$4,063,864 71

TOOLS AND MATERIALS ON HAND.

In office building	$8,550 53	
In repair department	1,327 80	
In meter department	2,455 84	
At reservoir grounds, pipes, specials, etc	20,711 89	
At reservoir grounds, horses, trucks, etc	3,482 47	
Inspector department	693 75	
At new pumping works	27,985 70	
		$65,207 98
Aggregate		$4,129,072 69

INVENTORY OF THE WORKS.

OFFICE.

Office building and lot	$60,000 00
Counter in office	1,041 00
Furniture in Board room	583 13
Twelve tables	200 00
Six book cases	660 00

Three wardrobes	$335 00	
Five desks	155 00	
Heating apparatus	1,400 00	
Three atlas maps	50 00	
Electric light fixtures	55 00	
Two tables	15 00	
Partitions	800 00	
Railing	50 00	
Thirty-three chairs	81 50	
Eleven office stools	42 00	
Two maps	18 00	
Clocks	15 00	
Miscellaneous properties	100 00	
Upstairs—		
One cabinet desk	30 00	
One small desk	10 00	
One upright desk	10 00	
Two book cases	35 00	
One table	10 00	
One cabinet drawing table	50 00	
Two drawing tables	35 00	
Drawing tools	70 00	
Maps and drawing	2,500 00	
Safe	200 00	
		$68,550 53

PUMPING WORKS.

Three lots corner of Atwater and Orleans streets	$41,250 00

REPAIR DEPARTMENT.

Tools and materials	$1,827 80

METER DEPARTMENT.

Valuation of meters in use	$50,187 49	
Valuation of meters in stock	2,030 55	
Valuation of tools	281 70	
Valuation of materials	143 59	
		$52,643 33

RESERVOIR.

Grounds including houses	$47,200 00	
Railroad siding	637 97	
Eight horses	700 00	
Six repair wagons	350 00	
Two sleighs	120 00	
One heavy truck	200 00	
Two light trucks	300 00	
Storage platform	400 00	
Seven pipe derricks	700 00	
Harness covers and blankets	74 50	
		$50,682 47

INSPECTION.

Three buggies	$45 00	
Five carts	500 00	
Five sets harness and covers	133 75	
Two pair	15 00	
		$693 75

NEW PUMPING WORKS.

Grounds	$250,000 00	
Inlet pipe	86,020 47	
Dock, basin, and canal	64,825 72	
Conduits and wells	72,187 06	
Engine, boiler, and coal houses	127,391 23	
Stand pipe and tower	29,804 25	
Pump wells	53,648 58	
Engines	255,000 00	
Boilers	35,000 00	
Engineer's house and barn	6,723 64	
Drawbridge and foundation	5,316 00	
Drinking fountain	175 00	
Underground improvements	16,325 29	
		$1,002,417 24

TOOLS AND MATERIALS ON HAND.

Tools	$1,101 24	
Materials (rope, waste, etc.)	829 70	
Materials (gauges, valves, etc.)	497 50	
Materials (iron, lead, etc.)	1,301 09	
Furniture	410 00	
Wood and coal	20,151 08	
Horses and vehicles	136 00	
Hoisting engines, gas and electric light plant and supplies	3,216 69	
Tools and implements (Hurlbut fund)	342 40	
		$27,985 70

IRON PIPE IN GROUND.

103 feet of 45 inch pipe	$1,699 50
44,909 feet of 42 inch pipe	612,177 14
715 feet of 36 inch pipe	6,403 55
49,337 feet of 30 inch pipe	323,386 40
73,278 feet of 24 inch pipe	371,321 08
416 feet of 20 inch pipe	1,751 80
87 feet of 18 inch pipe	278 40
26,101 feet of 16 inch pipe	77,992 60
3,527 feet of 12 inch pipe	7,547 25
96,423 feet of 10 inch pipe	144,868 47
190,715 feet of 8 inch pipe	211,875 30

713,674 feet of 6 inch pipe	$561,480 91	
795,432 feet of 4 inch pipe	503,731 08	
82,767 feet of 3 inch pipe	37,637 50	
2,636 feet of 2 inch pipe	659 00	
		$2,862,809 98

IN STOCK.

Iron pipe	$14,356 85	
Sleeves	411 65	
Bolted sleeves	282 37	
Hub bolted sleeves	607 23	
Tees	1,249 30	
Crosses	1,071 62	
Bends	140 07	
Bolted heads	65 20	
Hub capes	79 10	
Caps	105 87	
Curves	285 68	
Reducers	197 80	
Gates	905 50	
Gate boxes	360 00	
Coal	16 35	
Lead	662 10	
Packing	62 20	
Relief valves	126 00	
		$20,711 89
Aggregate		$4,129,072 69

In conclusion, I desire to express my appreciation of the courtesies that have been extended to us by the Fire Commissioners, the Board of Public Works and the Park Board and their several employees.

We are all striving to work harmoniously, and for the common good of the city; and during the past year, at least, I am confident that this disposition of the several Boards has been productive of much good.

All of which is respectfully submitted.

L. N. CASE.
Secretary.

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

Report of the Superintendent of Meters and Inspection.

DETROIT, January 2, 1892.

To the Board of Water Commissioners:

GENTLEMEN—In compliance with the rules of your honorable body, I herewith report the work done in the meter and inspection departments during the year 1891.

The following tables show the number of meters placed during the year, and the total number in service on the 31st day of December, 1891:

	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Total number of meters placed during the year 1891	190	82	100	26	24	10	8	440

Meters removed during the year, and for what purpose:

	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Not in use	17	3	8	......	3	1	......	32
For repairs	4	1	4	1	2	......	......	12
Too small for required supply	2	1	3	1	1	1	......	9
Too large for required supply	......	......	......	......	......	......	2	2
Received on approval and returned to owners	8	2	2	......	......	......	......	12
Total number removed	31	7	17	2	6	2	2	67

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Meters in service Jan. 1, 1891.	298	100	281	45	77	39	14	2	856
Meters placed during the year, and in service Jan. 1, 1892....................	159	75	83	24	18	8	6	......	373
Total number of meters in service Jan. 1, 1892......	457	175	364	69	95	47	20	2	1,229

The following tables show the kind and sizes of **meters** placed during the year 1891, also those removed:

Placed.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson	170	80	88	22	18	6	3	...	387
Crown	5	1	4	1	2	1	......	......	14
Hersey..	......	......	5	1	......	......	4	......	10
Worthington	1	1	......	......	4	2	1	......	9
Union Rotary.............. ...	8	......	2	2	......	1	......	......	13
Nash.................	6	......	......	......	......	......	......	......	6
Duplex	......	......	1	......	......	......	......	......	1
Total placed during 1891....	190	82	100	26	24	10	8	......	440

Removed.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson..................	15	3	6	2	3	......	......	......	29
Crown	5	2	5	......	1	2	.. ..	......	15
Hersey............	......	... .	2	......	......	......	2	......	4
Worthington...................	1	.....	......	......	2	....	......	......	3
Union Rotary..................	2	......	1	......	......	......	......	......	3
Nash..........................	6	......	......	......	......	......	......	......	6
Duplex........................	.... .	......	1	......	......	......	......	......	1
Niagara	2	2	2	......	......	......	......	......	6
Total number removed in 1891.	31	7	17	2	6	2	2	......	67

The following table shows the total number of meters in service and the different kinds and sizes, also indicators attached to hydraulic elevators:

KIND.	SIZES.									
	Indicat'rs	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson	......	383	151	229	48	51	26	4	2	894
Crown	......	45	17	51	12	13	7	4	.. ..	149
Hersey	......	4	5	52	3	13	2	8	......	87
Worthington	......	15	2	22	4	16	10	3	......	72
Union Rotary	....	10	......	6	2	2	2	1	......	23
Duplex	......	......	......	2	......	......	......	......	......	2
Equitable	......	......	......	1	......	......	......	......	......	1
Ball & Fitts	......	......	......	1	......	......	....	.....	......	1
Indicators	10	......	......	......	......	......	......	......	......	10
Total in service Jan. 1, 1892	10	457	175	364	69	95	47	20	2	1,239

Meters in stock January 1, 1892:

KIND.	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Thomson	11	3	9	2	4	4	1	34
Crown	7	1	2	......	.....	2	......	12
Worthington	2	2	......	......	1	......	......	5
Union Rotary	2	......	1	......	.....	......	......	3
Total number in stock	24	6	12	2	5	6	1	54

Valuation of meters in stock, January 1st, 1892	$1,605 26
Valuation of material in stock, January 1st, 1892	143 59
Valuation of tools in stock, January 1st, 1892	281 70
Total	$2,030 55

Valuation of meters in service, January 1st, 1891	$39,690 31
Deduct 10 per cent for depreciation in value	3,969 03
Present valuation of meters in service, January 1st, 1891	$35,721 28
Add amount expended during the year for meters placed	14,466 21
Total valuation of meters in service, January 1st, 1892	$50,187 49

Cost of material used in repairing meters during 1891	$10 24
Cost of labor in repairing meters during 1891	132 50
Total	$142 74

As you will see by the foregoing tables, we have placed 373 meters during the last year. Adding thereto, 856 meters and 10 indicators previously placed, makes a total of 1239 meters and indicators in service on the 1st day of January, 1892.

There have not been as many meters placed during the last year as in the previous year, but in proportion to the number placed, the same gratifying results have been produced as formerly.

After metering the livery stables, laundries, breweries, saloons and manufacturing establishments, we were under the impression that we had stopped the largest source of waste, but such has proven not to be the case. It seems to make no difference where we go, the same careless waste of water confronts us. Latterly we have been metering the principal stores in the central part of the city, and in a majority of them, the waste is very large, principally in the closets and urinals where the disposition seems to be never to shut them off, and in a great many cases they could not be shut even though the occupant was disposed to do so, as the plumbing is so defective.

Another source of great waste is in the tank elevators. Instead of the water being used over and over, as is supposed, through neglect, the automatic valves have become useless, thereby allowing a continuous flow of water, as there are no means of knowing when the tanks are full, the overflow passing directly into the sewer. In several instances, we have found them using 20,000 cubic feet per month, where it was supposed not 20 feet was being consumed.

It is surprising to find the great difference in the consumption of water by those in the same line of business. For instance, one drug store consumed 500 cubic feet in one month, while another of about the same size consumed 28,000 cubic feet. The first was formerly assessed at $15.00 per year, and the latter $20.00. Again, a block of offices formerly assessed at $182.00, consumed during the last year, 553,000 cubic feet, for which they paid $147.00, while another block somewhat smaller and with the same class of tenants on which the assessment was $150.00, consumed 1,104,000 cubic feet, for which they paid $285.00, showing a great waste in the latter, of which the owner was notified on several occasions. He finally concluded it was worth while to investigate the plumbing, and, if necessary, repair it. In doing so he has reduced the consumption from about 100,000 cubic feet to 23,000 cubic feet per month, and is now wondering why he did not give it attention before.

A merchant, who is a great advocate of the meter system, and whose assessment was $36.00 per year, wanted his premises metered. He was very careful of the water, allowing no waste whatever, and expected to save money by being metered. The first month's consumption was 38,000 cubic feet, cost, $10.42; second month, 13,800 cubic feet, cost, $4.20; third month, 7,400 cubic feet, cost, $2.60; and he expects to reduce it still more the present month, all of which goes to show how little attention is paid to the waste of water until a meter is placed on the premises.

There are very few who object to being metered. Occasionally a strong protest is made, and when it is we suspect bad plumbing the cause, and the meter proves us right in almost every instance. About the strongest protest against the meter came from an unexpected source, the leading spirit in one of our gas companies. He would not allow a meter to be placed on his premises, claiming that the use of water was so small that it would be a useless expense, as the only use was for drinking purposes and closets. No steam for elevator or heating. However, we placed a meter in the ground outside of the premises—as he would not allow us to go inside—and the first month showed a consumption of 33,500 cubic feet, cost, $9.14; and on presenting the bill were surprised to see what little faith he had in the accuracy of the meter. He was positive it was wrong, but decided to let it go for another month before fully condemning it. The second month showed a consumption of 40,400 cubic feet, cost, $10.85, and when he saw the bill, there was no question in his mind of the worthlessness of the meter, claiming that he had self-closing faucets on all openings, and there was absolutely no waste, and he wanted the meter removed. He almost convinced us that the meter was at fault, but it seemed to be working all right, and reading it daily showed that about 1,200 cubic feet were going somewhere, and on making a thorough examination of the premises, found all fixtures in good condition with the exception of some old style pan-closets which had been overlooked in making their repairs, and where the whole trouble lay. After having them changed to tank closets, the consumption has been reduced from 40,400 cubic feet to 3,200 cubic feet, the cost of which is $1.55. The meter has not been changed, but remains there fully vindicated as to its truthfulness.

After such instances as the foregoing (and there are many of them), one would think there ought not to be any objection to the meter, for it simply records the amount consumed and for which the consumer should pay.

INSPECTION.

The system of making a house to house inspection twice each year has been rigidly kept up, and in doing so, have found it necessary to employ five examiners, who have in addition to their regular duties, read the meters and delivered the meter bills each month, which has taken about one-quarter of their time.

They have made 71,919 examinations. It requires two, and sometimes three calls to each house where a leak is discovered. The occupant is given a stated time to have it repaired, a second call is made and in some cases (where the owner or occupant is in poor circumstances) more time is given, requiring a third call to see if the necessary repairs have been made. After the expiration of the time given, if the notice has not been complied with, the water is shut off.

There have been 3,436 leaks reported, of which 3,115 were repaired and 321 ordered shut off until such repairs were made. A large proportion of the leaks were small, caused by the packing in the bib being worn out, a defect which is very easily and promptly repaired. In some instances the water is found running full head with evidence of it being wilful, at the same time the occupant claiming it to be accidental, and there seems to be only one way to effectually stop the waste in such cases, and that is the meter. Otherwise as soon as the examiner is out of sight the water is running again, and the same excuse follows, but when a meter is placed on the premises it is surprising to see the effect it has on their memory. They seldom forget to stop the water when not in use.

I am pleased to say there has been a marked improvement in the plumbing during the last year. The plumbers generally have complied with our rules and regulations quite satisfactorily. Some ill feeling was caused by issuing a first and second class license. As I said to you in my communication of December 30, recommending the abolishment of the system, it was next to impossible to draw the line between a first and second class plumber. None would admit of their being second class workmen, and in nearly every case wanted a first class license. They claimed—and I think justly—that, as we had rules and regulations governing them, and also Inspectors to examine their work, if it was not done in a satisfactory manner they were compelled to change it, and after doing so the Water Board ought not to ask anything more. The very fact of them having to change their work, if not properly done, makes them very careful indeed, as to undo a portion or all of their work interferes largely with their profits, and of course, a plumber does not like to have anything of that kind occur.

In doing away with the second class and giving all plumbers a license, then holding them to a rigid compliance with our rules will be much more satisfactory to the plumbers generally and we will arrive at as good results as formerly. The foregoing change does away with the necessity of the Examining Board of Plumbers. The fact that they do their work to the satisfaction of the Water Board shows their capability of doing first class work, and as that is the point we have been trying to arrive at nothing further can be gained, and for that reason I recommended its discontinuance.

The following table shows the work of the Examiners in the eastern and western divisions:

	EXAMINATIONS.	LEAKS REPORTED.	LEAKS REPAIRED.	ORDERED SHUT OFF.
East Woodward Ave.	36,040	1,753	1,640	113
West " "	35,939	1,683	1,475	208
TOTAL	71,979	3,436	3,115	321

The following table shows the duties performed by the Inspectors of new work:

	Calls for Non-payment.	Shut for Non-payment.	Examined New Connections.	Examined Exten's and Fixtures.	Let on New Connections.	Notified for Building Tax.	Shut for Vacancy.
John Wallace..	405	181	710	174	663	50	120
John Hatzenbuhler........................	759	425	865	73	769	41	29
Michael Hart.................	876	670	649	135	470	75	80
John Becker..........	992	422	390	238	229	125	79
C. J. Paterson............................	518	439	687	157	480	97	113
TOTAL...............	3,550	2,137	3,301	777	2,611	388	421

Attached to this report is a complete list of tools on hand, and an itemized account of the material in stock on the 31st day of December, 1891.

Before closing this report I want to thank the Board for their uniform kindness in the past, and also the Secretary for his very courteous treatment at all times. When any complications have arisen I have consulted him, and owing to his good judgment and convincing arguments, together with the active interest taken in the meter system, we have moved along with the least possible friction in our department.

All of which is respectfully submitted.

T. R. PUTNAM,
Superintendent Meters and Inspection.

REPORT OF SUPERINTENDENT OF GROUNDS.

Report of Superintendent of Grounds.

To the Honorable Board of Water Commissioners:

GENTLEMEN—In accordance with the regulations of the Board I respectfully submit to your honorable body my report of the work performed upon the grounds at the pumping works, together with such recommendations in regard to future operations as seem to me wise for the coming year.

The work performed has of course been almost entirely of a routine nature, as it has been the wish of the Board, on account of the unsettled condition of the Hurlbut legacy, to keep the grounds from deteriorating rather than to make any general improvements.

The strip along the east line fence south of the engine house, through which the new inlet was laid in 1890, has settled firmly, and we have leveled it to the proper grade and sown grass seed, and expect a fine greensward by June 1st.

About one acre in the northeast corner of the grounds became badly covered with quack grass and weeds, although careful and continual attention was given to prevent such growth.

The only remedy left was to plough the piece, harrow well, and sow grass seed, which was done.

Along the west side of the canal is a strip that is so covered with thistles and weeds that I would advise ploughing it in the spring, and sowing oats and seeding clover, as oats are of value to the Board. With the permission of your honorable body I will carry out this plan upon the opening of spring.

Acting under instruction from your Committee on Pumping Works, about the middle of July I worked out the floral design, "Welcome G. A. R., 1891," in the plat of grass near the engine house. Owing to continual cool weather the plants were not at their best during G. A. R. week but were, I think, equal to anything of the kind in the city.

We have utilized the engine house gallery to keep the plants through the winter, but I am sorry to say that they are not doing very well, although a steam pipe has been laid, and the temperature thereby preserved in an equable condition. There seems to be other reasons why the plants do not do well, one is I think the atmosphere is too dry, and another that there is not sufficient light; however, I hope to save most of them, as it is my intention to make a few flower beds in the spring, but of course we can not expect very satisfactory results until we have a proper green-house.

I have been instructed by your committee to inquire as to the probable cost, method of heating, etc., of a green-house, suitable for our present use; and I would respectfully report that I have inspected several green-houses in the city, and am of the opinion that three hundred and fifty dollars would cover cost, aside from facilities for heating, which would cost about one hundred and fifty dollars for piping, if you should conclude to use live steam from our boilers.

In giving the estimate of the cost of a green-house I have done so under the idea that I may control the construction of the same, after the plan thereof has been approved by the Board, and that I be permitted to purchase the material therefor, and have the same erected by days' labor.

Last year I recommended placing a new iron fence along the Jefferson avenue front, also laying sewer crock, and filling in the road ditch. These improvements would add very much to the general appearance, and I hope your honorable Board will deem it expedient to have these improvements made during the ensuing year.

In conclusion, there is a matter that is giving me considerable uneasiness, and that is the contemplated widening of Jefferson avenue, and the evident prevailing idea that the said additional width be taken from the property upon the south side of the avenue.

Should this idea be adopted the results to the grounds would be very unfortunate, as the row of maples immediately along the Jefferson Avenue line, which were originally set out to conform with a general plan of ornamentation, and which are now about twenty years old and in a very flourishing condition, would have to be cut down or removed back farther at a considerable expense, and probably a loss of some of the trees. I have thought it best to call the attention of the Board to this, what appears to me, a very grave matter, in order that they may be fully apprised of such contemplated action, and oppose the same should they deem it wise to do so.

Accompanying this is a report of expenditures and inventory of tools and material on hand in this department.

Respectfully submitted.

E. A. SCRIBNER,
Superintendent of Grounds.

REPORT OF THE CHIEF ENGINEER AT PUMPING WORKS.

Report of Chief Engineer at Pump

DETROIT, Janu

To the Board of Water Commissioners:

GENTLEMEN — I have the honor to submit the Engineer's report for the year 1891.

The following table shows the number of gallons of water pumped, and cost of fuel for the years named:

YEAR.	GALLONS OF WATER PUMPED.	COST OF FUEL CONSUMED.	AVERAGE DAILY DELIVERED.
1852	235,840,271	....	646,411
1853	303,531,743	$2,129 37	931,594
1854	376,265,126	2,271 34	1,030 866
1855	542,807,364	3,325 81	1,487,143
1856	692,124,305	4,017 44	1,896,231
1857	697,190,523	3,993 20	1,909,837
1858	718,091,207	3,655 20	1,967,373
1859	782,112,587	3,194 15	2,142,774
1860	870,036,451	4,196 21	2,383,580
1861	895,129,423	4,414 07	2,452,409
1862	994,945,329	3,150 95	2,725,878
1863	1,035,798,043	4,670 86	2,837,803
1864	1,018,390,256	7,647 62	2,839,078
1865	1,049,514,887	7,372 89	2,875,383
1866	1,196,317,922	9,349 16	3,277,583
1867	1,425,535,230	10,121 82	3,905,576
1868	1,666,545,125	11,379 23	4,507,248
1869	1,946,810,325	11,247 92	4,511,809
1870	1,866,060,068	12,713 78	5,112,493
1871	2,300,150,605	14,681 05	6,301,782
1872	2,782,292,578	17,736 86	7,601,892
1873	3,198,393,948	20,233 30	8,762,723
1874	3,289,872,635	20,431 71	9,013,350
1875	4,207,454,260	21,393 98	11,527,272
1876	4,065,134,470	19,832 89	11,107,499
1877	4,213,239,790	17,433 72	11,543,123
1878	4,345,743,330	10,943 82	11,906,146
1879	5,129,599,110	11,219 51	14,053,696
1880	5,552,965,310	12,276 60	15,172,036
1881	6,543 127,968	16,556 63	17,926,377
1882	6,284,000,742	13,156 16	17,261,440
1883	7,379,327,188	16,495 99	20,217,334
1884	8,510,614,140	19,877 07	23,253,044
1885	9,970,829,580	21,341 48	27,317,341
1886	10,576,571,254	20,387 24	28,976,907
1887	13,168,859 808	35,882 83	36,079,166
1888	14,380,166,670	39,568 66	39,397,716
1889	12,875,334,453	34,413 31	35,274,888
1890	12,120,944,532	31,852 40	33,208,067
1891	12,057,261,236	33,826 86	33,033,592

The following tables show in detail the work done by each engine during each month of the year.

ENGINE No. 1.

MONTHS.	Time run.		Revolutions.	Gallons.	Cost of Kindling.	Pounds of Coal.	Cost of Coal.	Cost of Nat. Gas.	Total Cost.	Duty.	No. gals. with 1 lb. coal.
	H.	M.									
January	743	40	396,747	307,082,178	$3 00	41,025	$ 87 17	$712 74	$802 91	77,949,224	812
February	672	....	354,648	274,497,552	3 75	60,631	128 84	616 58	749 17	74,676,166	778
March	744	....	377,482	292,177,068	3 75	80,505	171 07	659 00	833 82	71,416,510	744
April	720	....	363,441	281,308,334	3 75	83,799	178 07	593 17	774 99	73,978,071	771
May	192	....	93,512	72,378,288	1 87	....	....	196 11	197 98	74,514,739	776
June	504	....	241,992	374,603,616	62	6,648	14 14	1,023 26	1,038 02	73,550,961	767
July	744	....	347,620	538,115,760	3 75	153,862	326 95	1,168 88	1,499 58	73,136,091	762
August	430	....	231,543	358,428,564	2 50	43,900	93 27	895 40	991 17	73,703,695	768
September	216	....	118,159	182,910,132	5 00	24,522	51 10	456 25	512 35	72,761,960	758
October	387	50	161,583	250,130,484	2 35	126,947	269 76	407 11	679 22	75,057,930	782
November	91	15	26,686	49,265,874	3 12	10,414	22 12	119 97	145 21	69,161,153	720
December	572	10	303,439	234,861,786	2 69	3,814	8 10	682 84	693 63	69,012,236	719
Total	6,016	55	3,026,852	3,215,754,636	$36 15	636,067	$1,350 59	$7,531 31	$8,918 05	....	......

ENGINE No. 2.

MONTHS.	Time run.		Revolutions.	Gallons.	Cost of Kindling.	Pounds of Coal.	Cost of Coal.	Cost of Nat. Gas.	Total Cost.	Duty.	No. gals. with 1 lb. coal.
	H.	M.									
January	774	....	395,289	635,624,712	$3 00	144,971	$308 06	$1,474 23	$1,785 29	73,759,245	756
February	672	....	370,169	595,231,752	3 75	141,115	299 86	1,338 93	1,642 54	73,883,020	770
March	744	....	406,752	654,057,216	3 75	198,501	421 81	1,475 98	1,901 54	70,104,040	731
April	624	....	337,195	542,209,560	....	172,350	366 24	1,144 10	1,510 34	73,169,183	732
May	552	....	295,467	237,555,468	1 87	13,144	27 93	645 59	675 39	71,669,102	716
June	576	....	303,383	404 905,656	62	7,170	15 23	1,105 39	1.121 24	73,600,374	767
July	744	....	379,053	609,517,224	3 75	174,163	370 09	1,323 13	1,696 97	73,205,238	763
August	499	45	221,087	355,507,896	2 50	43,540	92 52	887 90	982 92	73,713,146	768
September	456	....	280,906	235,399,944	5 00	31,641	67 23	589 15	661 38	72,544,195	756
October	588	30	307,291	374,964,696	2 35	189,916	403 57	609 00	1,014 92	75,299,128	784
November	384	35	198,099	174,507,396	3 12	36,983	78 58	426 05	507 75	70,088,743	730
December	744	....	434,490	698,659,920	7 00	11,382	24 21	2,036 84	2,068 05	68,853,762	718
Total	7,828	50	3,929,181	5,518,141,400	$36 71	1,164,876	$2,475 33	$13,056 29	$15,568 33	....	......

ENGINE NO. [illegible]

MONTHS.	Time run.		Revolutions.	Gallons.	Cost of Kindling.	Pounds of Coal.	Cost of Coal.	Cost of Nat. Gas.	Total Cost.	Duty.	No. gals. with 1 lb. coal.
	H.	M.									
January	......	...	....	....	......	......	....	....	....	....	......
February	......	...	....	....	......	......	....	....	....	....	......
March	......	...	....	....	......	......	....	....	....	....	......
April	396	....	51,837	93,306,600	$3 75	29 755	$63 22	$196 32	$263 29	73,281,080	764
May	744	....	391,279	704,302,200	1 87	39,044	82 96	1,917 50	2,002 33	71,692,093	746
June	360	....	176,841	318,313,800	68	5,660	12 02	870 05	882 70	73,414,647	765
July	......	...	....	....	......	......	....	....	....	....	......
August	552	....	277,471	499,447,800	2 50	61,182	130 01	1,247 99	1,380 50	73,740,696	768
September	696	....	368,736	663,724,800	5 00	89,281	189 72	1,662 10	1,856 82	69,560,467	725
October	432	....	225,204	405,367,200	2 85	205,154	437 01	659 49	1,098 85	75,236 000	783
November	648	....	354,946	638,902,800	3 18	185,726	288 43	1,564 53	1,856 09	70,156,126	731
December	......	...	....	....	......	......	....	....	....	....	......
Total	3,828	...	1,846,314	3,323,865,200	$19 23	566 802	$1,203 27	$8,117 98	$9,340 48	....	......
Aggregate	17,173	45	8,802,347	12,057,261,236	$92 09	2,367,245	$5,029 19	$28,705 58	$33,826 86	....	......

Fuel consumed	$33,826 86
Salaries, engineers and firemen	16,911 03
Polish	28 50
Repairs and material for repairs	781 83
For gas attachments	530 59
For electric light	308 24
Lubricators	261 04
Packing, rags, waste, etc	265 26
Tools, lamps, etc	77 20
Freight and express	9 72
Street car tickets	9 50
	$53,012 77

Cost per million gallons, $\$4.39\frac{6}{10}$.

Engines One and Two were run part of time with only one pump attached.

In figuring the duty in foot pounds, I have taken the total cost for fuel and reduced the same to coal, at $4.25 per ton.

By referring to the tables you will notice the daily average is 33,033,592 gallons, which is less than the average last year. This showing is remarkable considering the number of miles of new mains laid in the annexed territory, supplying 3,301 additional consumers. It is very evident that as the meter system is extended, the waste of water becomes less, and is proving a great benefit to the city, not only in reducing the expense of additional pumping facilities and water mains, but is making it possible to furnish a better head of water. This alone ought to satisfy the citizens of the wisdom of adopting the meter system.

I doubt that the present low water rate would have met our running expenses, if the meter system had not been adopted. You will notice our cost for fuel is more than in 1890; this may be accounted for by the better head furnished. The water in the river has been lower than ever before, and we have raised it a greater heighth than any year since I have been connected with the Water Works. Every additional inch the water is elevated adds to the cost.

I am glad to report that the engines are in good order, although hardly any repairs to either of them have been made the past year. You will see the duty shows rather lower than former years. The reason of this is the numerous changes from coal to gas, and *vice versa.* A great many times the pressure on the gas gauge would show very little gas, and for fear of complete failure, and for safety, we would start fires in the four coal boilers. By the time the coal boilers began to make steam the gas would come to usual pressure and of course the coal would be consumed making a great waste of fuel, which counts against the duty of the engines.

The four boilers in the west boiler room have been in almost constant use for nearly fifteen years and of course the plates are somewhat weaker although as soon as any defect shows I have had the same repaired immediately in the best possible manner. The boilers in the east boiler room have been in use about ten years, and have had some repairs and are now in very fair order. When it becomes necessary to have new boilers I would suggest bushing the high steam cylinders in the three engines so that we could carry about 125 or 130 pounds pressure; we would get greater benefit from expansion, as the expense of evaporating 130 pounds of steam does not cost in the same ratio as the first fifty or sixty pounds.

I do not hesitate to say, with higher steam and the engines bushed as I have suggested, they would do a duty of 100,000,000 foot pounds. As to the wisdom of this proposed change, I would respectfully refer to Commissioner Kirby as he will readily understand these poinst. Of course none of these suggestions could be carried out until a new engine was erected, and I now urge, as I have heretofore, the necessity for another engine, as I am satisfied during next summer we will need to run all three engines to supply the demand for at least four hours daily while there are thousands of hose running full head. The demand for water is so very irregular; through the day we may be pumping at the rate of thirty-five million up to about four o'clock; from then until 8.30 we would be pumping at the rate of fifty to sixty millions; after that time we keep checking down and run as slow as possible. So you can see that as we have boilers enough through the day we have more than enough through the night. Although the boilers may be banked or the fire checked down, the fuel is being consumed without the engines getting any credit for duty.

You will bear in mind that the reserve engine serves as a reservoir, but if while we are depending so much on this engine, one of the engines should become disabled, which may happen any time, you can readily see the city would be with a short supply, and I do not think it wise to take this risk. The past year has been a very favorable one for the Pumping Works, as hardly a week passed without a shower of rain. If the time for the use of hose was limited to morning and evening, it would be a great advantage to us and the citizens would not be inconvenienced. This rule is in force in other cities and why not in Detroit?

I have lately visited all the large manufacturers in the city that are using crude oil for fuel, and I find it to be a very satisfactory fuel, all users speaking in the highest terms of it. With good combustion the heat is distributed very evenly on the boilers, and I venture to say 30 to 40 per cent. cheaper than coal or natural gas, and I would recommend having the necessary fixtures put into the four boilers in the east boiler room.

I can see no economy in gas over coal, and experience teaches us that we run a great risk of short supply, as has happened several times during the year, as I have before mentioned. It is a very clean fuel and easy to control, but I can not recommend its continual use.

I am thankful to the Board for having adopted new rules governing the employees, and especially that of having three assistants, either of whom have full charge during my absence. These assistants have eight hour watches and are held responsible, and as I have every confidence in them, I am relieved of considerable anxiety and care.

I am also glad to report that the employees are faithful in the performance of their duties, and the orders of the Board are obeyed to the very letter. The utmost satisfaction prevails throughout this department.

Respectfully submitted.

JOHN E. EDWARDS,
Engineer.

REPORT OF THE SUPERINTENDENT OF EXTENSION AND CONSTRUCTION.

Report of the Superintendent of Extension and Construction.

DETROIT, January 2d, 1892.

To the Board of Water Commissioners:

GENTLEMEN—In accordance with the regulations of your Honorable Body, I have the honor to present my annual report relative to the general condition and progress of the work in this department.

This has been another year of very large extensions to our pipeage system, one of the largest on record, over 43 miles of pipe having been laid.

At the commencement of the year we had anticipated but a small outlay for this part of the work, and, had it not been for the taking in of so much new territory, and annexing it to our city, the outlay for extensions would have been comparatively light. But in view of the fact that such annexations have been made it became evident that a larger provision of pipeage would of necessity have to be made to meet the anticipated numerous calls upon your Honorable Body for extensions in this line of the work. So in consideration of this fact, I was instructed to make such estimates of our needs as in my judgment would be required to meet the present, and in some degree, the future needs of these annexations.

As a result of such estimate it became necessary to increase our order for pipe about 200 per cent. Though much of this has been laid in the new territory, the greater amount of the large pipe was laid within the old line of the city, from which we expect to derive a dual purpose therefrom of an abundant supply for all the newly annexed territory and all of the high grounds south of the old line of the northerly section of our city. The pressure in this section having been greatly diminished by the increasing demands upon the previously laid mains and a lack of a more bountiful supply.

To meet the needs as above stated a 30-inch line of main was laid in Collins Street from Canfield Avenue to Griffin Avenue, and, from which, and connecting thereto, a line of 24-inch main was also laid through Griffin Avenue and the North Boulevard, from Collins Street to about 450 feet west of Sullivan Avenue, and from this line of 24-inch, a 16-inch main was laid in Woodward Avenue, from the North Boulevard to the intersection of Wilkins and Woodland Avenues, and to which all cross connections have been made where streets have been opened.

About 20 miles of distribution pipes and mains have been laid in this new territory, ranging in size from 4 to 16 inches.

The object of taking the North Boulevard for this northernly supply main, was, because this is the only direct unobstructed thoroughfare through which such a line of main could be laid. To have laid in any other street or avenue save this one, and in this district, would have caused the placing of a number of very objectionable angles and bends, and also added to the length and cost of laying the same, as well as greatly diminishing the flow by the added friction. And, it is doubtful whether we could have got through to the point we desired in any other way, from the way the streets are laid out in this section of the city. It is only necessary to give a casual glance at the city's map to be convinced of this fact. It may be well to add that special care was taken in laying the mains through this section of the Boulevard, every foot of earth filling having been thoroughly pounded in where the mains have been laid in the roadway, and to meet the needs of the resident property, branches were set on both sides of the Boulevard with pipe connections, the intention being to lay a line of pipe just outside the fence line, to avoid contact with the road beds and the lawns; this being the original plan of the early Park and Boulevard Commissioners. A line is already laid on the south side of the North Boulevard from Woodward Avenue to a few feet west of Russell, and a number of shorter sections west of Woodward Avenue.

Considerable improvements are still being made as circumstances demand in the older portions of the city, by the replacing of some of the smaller lines of pipe with pipe of larger size, and the laying of pipe in some of the streets where pipe have not as yet been laid. The object being to meet the many changes that are constantly going on in some of these localities, calling for a greater supply of water.

The following are some of the streets and avenues in which improvements have been made in our pipeage: Miami Avenue, from Gratiot Avenue to Witherell Street, and in Witherell and Park Streets, from Miami to Washington Avenues, 16-inch mains laid; John R. and Clifford Streets, from Miami to Washington Avenues, and in Wilcox Street, from Miami to the west side of Woodward Avenues, 12-inch main laid; Washington Avenue, from Grand River Avenue to Park Street, 10-inch pipe laid; Russell Street, from Catherine to Maple Streets, 8-inch pipe laid, replacing 4-inch pipe.

RECOMMENDATIONS.

We are realizing the need of a more static head and supply of water at the intersection of Rivard, Maple and Gratiot Streets. I have thought it wise to recommend the laying of an additional line of pipe in Rivard Street, from the 24-inch main in Watson Street to Gratiot Avenue, and in Gratiot Avenue, from Rivard Street north to Rivard Street south; this line to be either 10 or 12-inch pipe. The laying of this line will greatly help the smaller pipe in this section. All through this locality, as you are aware, are numerous calls for copious supplies of water.

I find by the Secretary's records of pressure at No. 11's engine house, corner of Gratiot and Grandy Avenues, we have but a very low head, and one which fluctuates greatly at certain hours of the day. This is no doubt owing to the meager supply through the small size of some of the pipe in this section. To remedy this I would recommend the laying of an 8-inch pipe in Calhoun Street, from Chene Street to Grandy Avenue, connecting the same with the 30-inch main in Chene Street, and the replacing of a section of 4-inch pipe in Grandy Avenue, from Pierce Street to Gratiot Avenue, with 8-inch pipe.

Watson Street, 24-inch main. When the embankments of the abandoned reservoir in line of Orleans Street are taken down, a much needed improvement can be made in the 24-inch mains in this place, leading to and from the reservoir, by dispensing with a number of very sharp angular connections that are now in these lines, thereby giving a freer outflow to the Watson Street main. I find on examination of this main that it lays diagonally with the street between Riopelle and Russell Streets, and near to Russell Street; this main is partly under the north wall of the sheds of the House of Correction, and at the intersection of Watson and Russell Streets, there is quite an offset in the main which could be remedied by taking up a section and relaying in a proper line with the street. It would be well to do this the coming season.

North Boulevard, 24-inch main. To finish out this line in accordance with our proposed plan, it will require the laying of an additional length of 2,100 feet; this will carry the line west of Grand River Avenue, and beyond the Boulevard.

As we are anticipating the work in the extension department to be light the coming season as compared with the previous two years, I would respectfully recommend that the balance of the wood pipe be taken out and replaced with iron pipe. There is now less than nine miles in use; this amount can readily be done the coming season, and will rid us of this log system.

During the early part of last season the final connection of the 36-inch main in St. Aubin Avenue was made with the lower 42-inch main in Congress Street, a section of which was cut out and a 36x42-inch branch inserted. Since connecting these mains we have a more static head, and by this arrangement of the mains we have a dual system of supply for the densely business portion of the city; two relief valves were set in connection with this work.

The new line of 30-inch main laid the past season in Collins Street was connected with the upper 42-inch main, at the junction of Collins Street and Canfield Avenue ; a relief valve was set at this point.

Relief valves—During the past season several relief valves have been placed on some of our larger mains, for the purpose of counteracting as much as possible any water hammer that may be caused by a quick closing of the larger connections along these lines or from any other cause. This valve is one of my own design, simple in its action and construction of the double-seated poppet valve design. The valves proper are flat disks, and as near equal in size as practicable, thereby reducing the weight of the counter balance to a minimum. The seats have brass bushing, the valves are faced with sole leather, the body and disks are of cast-iron, the valve stem of wrought-iron.

The pipes for our extensions were furnished by the Detroit Pipe & Foundry Company; the specials by the Riverside Iron Works, of Detroit.

PIPEAGE.

The amount of distribution pipe and mains laid and relaid, and iron and wood pipe discontinued during the past season, is as follows: Total iron pipe laid and relaid $43\frac{2531}{5280}$ miles, of which 1,812 feet was relaid, and in addition to this 2,757 feet was laid for private use. This amount is not included in the above mileage. Wood pipe discontinued $1\frac{5057}{5280}$ miles, and iron pipe 4,803 feet, making the net increase of the pipeage $42\frac{1196}{5280}$ miles. This amount added to the measured lines of iron and wood pipe connected with the Works, will make the total length $401\frac{5060}{5280}$ miles, of which $393\frac{2528}{5280}$ miles are iron and $8\frac{2532}{5280}$ miles wood pipe, which in detail is as follows:

SIZE OF PIPE IN INCHES.	MEASURED LENGTH IN FEET FOR 1890.	ADDED LENGTH IN FEET, 1891.	DISCONTINUED LENGTH IN FEET, 1891.	TOTAL LENGTH IN FEET FOR 1891.
45	103	......	......	103
42	44,909	......	......	44,909
36	695	20	......	715
30	42,326	7,011	......	49,337
24	55,013	18,265	......	73,278
20	461	......	......	461
18	87	......	......	87
16	15,962	10,139	......	26,101
12	1,973	1,554	... ..	3,527
10	88,527	7,896	......	96,423
8	156,109	34,606	1,546	189,169
6	637,167	76,507	335	713,339
4	724.036	71,396	1,889	793,543
3	84,602	371	1,033	83,904
2	. 2,636	......	......	2,636
TOTAL..	1,854,606	227,765	4.803	2,077.568

TABLE OF PIPEAGE AS ARRANGED BY WARDS.

WARD.	4 In.	6 In.	8 In.	10 In.	12 In.	16 In.	18 In.	20 In.	24 In.	30 In.	36 In.	42 In.	45 In.	2 In.	3 In.	Logs.	Lead.	Totals.
First Ward	71,322	37,364	12,213	26,882	1,092	13,841			6,754	3,934		2,349			5,677	1,377		182,805
Second "	51,877	37,160	5,243	15,782	412	5,158			5,713	4,184					4,142	232		129,903
Third "	41,732	25,285	5,043	5,571		2,124			4,548	2,399		1,679			6,247	6,437		101,065
Fourth "	64,227	37,420	6,233	96		2,254			5,323	3,253					6,697	1,662		127,165
Fifth "	59,642	13,565	6,588	8,911		1,012			3,678	2,513		1,749			3,887	6,521		108,086
Sixth "	54,752	26,825	10,258	3,871		765			5,483	2,533					5,428	251		110,166
Seventh "	48,816	15,045	15,073	3,251	1,027	745		406	11,248	3,083		1,829			2,908	761		104,192
Eighth "	47,061	38,730	20,227	161					4,493	2,153					8,358	7,006	175	128,364
Ninth "	55,076	55,240	6,017	471	946				2,433	12,063	715	3,369			9,918	8,871		155,119
Tenth "	76,711	68,625	18,292	6,971					8,403	2,443					4,323	446		186,214
Eleventh "	53,111	43,775	2,077						1,463			3,479			8,188	9,771		121,864
Twelfth "	28,991	51,605	18,492	3,951	50	182	87	55	2,923	2,593					5,718	446		115,093
Thirteenth"	59,001	30,695	5,842	441					513	7,173		7,519			7,858	991		120,033
Fourteenth"	26,961	67,690	17,052	5,061					10,303	1,013					3,143		160	131,383
Fifteenth "	21,366	63,815		3,821								9,249						98,251
Sixteenth "	19,981	70,420	16,522	10,736											1,448			119,107
Annexed Territory	12,916	24,900	23,997	446								13,687	103	2,636				78,685
Outside of City		5,180																5,180
Totals	793,543	713,339	189,169	96,423	3,527	26,101	87	461	73,278	49,337	715	44,909	103	2,636	83,940	44,772	335	2,122,675

During the past year 569 gates have been set, 44 gates reset, and 25 gates taken out. Of the 569 gates set, 170 were blow-off gates, of the 44 gates reset, 41 were blow-off gates, and of the 25 gates taken out, 19 were blow-off gates.

No. of Each Kind.	Name of Gates.	Diameter in Inches.	Remarks.
1	Michigan B. & I. Works	36	Set.
5	Murdock Valve Co	30	"
11	" " "	24	"
8	" " "	16	"
5	" " "	12	"
23	" " "	10	"
87	" " "	8	"
120	" " "	6	"
3	Michigan B. & I. Works	6	"
280	Murdock Valve Co	4	"
9	" " "	4	Reset.
8	Michigan B. & I. Works	4	Blow-off.
5	Flowers Bros	4	" "
5	Pittsburgh	4	" "
9	Ludlow	4	" "
38	Miscellaneous gates	4	" "

There are now 3,843 stop gates in use in the mains and distribution pipe, ranging in size from 3 to 42 inches, and in addition to this number we have 552 blow-off gates in size from 3 to 24 inches.

There are now conneted with the water mains 1,968 fire hydrants and 439 reservoirs; 140 hydrants and 19 reservoirs were added the past year.

It has occurred to me that some mention should be made as to what extent your honorable body are doing from year to year, specially for the Fire Department, in the way of setting branches, and laying of extra lines and larger mains. We have in the past two years laid about five miles of main, mainly for fire extinguishing purposes, and in the past eight or ten years many additional lines have been laid for this purpose alone. During the past six years not less than 1,200 branches were set and connected with some of the larger street mains. These in the main aggregate no small amount to the cost of our construction. It may be safely estimated that not less than $2,500 are spent yearly for this department alone. We do not mention this fact for any other reason than to show to our citizens what the Water Board is doing for this department to provide fire protection to our homes and business interests. It has been my orders, in the fifteen years I have been in the employ of your honorable body, to make suitable provision both for pipe and branches to this end. I am pleased to say, that though the amount of work done by the Water Board for the other departments of the city has been greatly in excess of that returned, it is only courteous to say that the Fire Department has rendered us very valuable service, by the use of their steamers in displacing the water in the mains when making our large connections, and also at such times when serious breaks have occurred in the same.

TABLE OF SERVICE CONNECTIONS,

With iron and wood pipe, of sizes from ⅝ inch to 6 inches, in detail, as follows:

Size of Connections with Iron and Wood Pipe.	Number Reported in 1890.	Number Added in 1891.	Number Discontinued in 1891.	Total of Each Kind.
Cast iron, 6-inch diameter...	3	......	......	3
" " 4 " "	51	7	......	58
" " 3 " "	72	10	......	82
" " 2 " "	78	11	......	89
" " 1 " "	4,242	1,022	......	5,264
" " ⅝ " "	14,657	2,440	......	17,097
Wood pipe..................	611	......	161	450
Mixed sizes...	20,677	......	8	20,669
Grand total............	40,391	3,490	169	43,712

REPAIRS DEPARTMENT.

This department of the work has received prompt attention in the many items coming under its care. Three thousand four hundred and ninety taps were made with the distribution pipes, of sizes from $\frac{5}{8}$ to 4 inches.

The break which occurred in the 30-inch main in Congress street, between Second and Third streets, was promptly repaired. It was very fortunate that it occurred during the middle of the day, enabling the repair department to give it prompt action in closing the main gates. The broken pipe was taken out and a new length put in, the water being let on again the day following. In carefully examining the pieces as they were taken out, I could find no defects which could have caused the break, the metal was very homogeneous in quality and thickness, it is quite possible the joint may have been overcalked, as the break was from the hub end.

Pumping Works—The No. 1 inlet pipe was taken up the past year, and a new trench dredged out to receive it; the lay of the pipe previous to this was in a diagonal line crossing the grounds, and in dredging out a trench for the No. 4 inlet pipe, a portion of the pipe slid into said trench, rupturing two of its joints. This line of pipe has, as I have already stated, been taken up, and it has been relaid again in a line parallel with the grounds, and will have when completed an additional length of 500 feet, making a total length from the shore line of 1,505 feet; five of the lengths and two strainer boxes and one relief valve box are yet to be laid. Owing to unforeseen delays, and the cold weather being upon us we were unable to complete the laying of the same. The balance of the pieces will receive early attention the coming season.

In connection with the above mentioned work, a line of brick conduit and gate and strainer well was built. This conduit and well were built to take the place of the old gate and crib house, and a section of the iron inlet pipe running through the river bank. The conduit has an inner diameter of 5 feet. The well is 22 feet deep, with a diameter of 18 feet; the top is arched over with brick, sprung from a number of I beams, two man-hole frames are built in the same. The well is fitted with strainer plates, two pipe thimbles of cast-iron are built in wall of the well and conduit, two box sluice gates are bolted to the thimbles, each having an opening of 5 feet diameter. The entire brick work was done by men in our employ, and has been executed in the most satisfactory manner.

The contract for dredging, taking up and relaying the inlet pipe, was awarded to Capt. Thomas Davis, of Detroit. The extra lengths of the iron inlet pipe to Stephen Pratt, of Detroit, and the box sluice gates, with the adjuncts, to the Russel Wheel & Foundry Company, of Detroit.

Considerable labor has been done on the south end of the grounds adjoining the river, in connection with the above work. The excavations of the conduit and well were hauled to the dock, and deposited along the line of the same.

Considerable grading was done at the south bank, and the surplus earth taken to the dock.

I am pleased to know that your Honorable Body have decided to have the dividing dock rebuilt the coming season. This is a very much needed improvement, the dock having been in a very unsafe and unsightly condition for some time.

When doing this work it will be well to lower the dock 18 inches to 2 feet, as the dock has always been too high, and at the present stage of the river it is doubly so. It will require some changes in the previously made plans, as we wish to simplify the work and reduce the cost to a minimum, until it becomes necessary to build of stone.

Surface Inlet—It is thought advisable to extend the same to a point in line of the south end of the dock; this will require the laying of about 700 feet of iron inlet pipe. It would be well to do this work the coming season.

The work of making a branch connection between the said surface inlet to the gate well of the No. 4 inlet may be delayed until it becomes necessary to do something with the settling basin.

It will be seen from the tenor of my last year's report that some extensive repairs would be needed upon the settling basin and dock during the season just closed. And, as neither of these have received the projected repairs, I have thought it proper to give some explanation why this work was not prosecuted.

It has been a matter of no little concern, as from year to year the question has arisen, what ought to be done to the settling basin; fifteen years of continuous use having given rise to the conjecture that with this length of time it must be in anything but a pleasing condition. The intention having been that when it became necessary to make any extensive repairs upon it, the most substantial thing to do would be the paving of the inner surface and the building of the dividing wall or dock with stone and concrete. As a work of this kind could not be done without a very large outlay, it was deemed prudent to pump out the settling basin and ascertain to what extent a work of this kind would require, and what the probable cost would be to carry out such project. So during the close of the month of October, and the early part of November, the basin was pumped out, exposing its entire inner surface to view for inspection, and on November 5th your entire body accompanied by some of your officers, had the pleasure for the first time of seeing the inside of the basin, and as a result of which the many conjectures as to unsightly objects were not to be found, but to our astonished gaze we found what looked to us a most fertile valley, a short growth of sea grasses covering almost every available spot that was not otherwise covered with gravel. So in view of the cleanly appearance of the basin it was thought unwise to spend the amount necessary to prosecute this work, as proposed, at least for several years to come.

It has been suggested to me, by the Secretary, that a description of the settling basin, with its adjuncts, and a general lay of the grounds at the pumping works, would be of interest to the many readers of our yearly reports. In compliance with this request, I shall endeavor to be as concise as possible, and confine myself to the branch of the work immediately under my care.

Since the starting up of the work in the fall of 1877, many changes have been made in the general arrangements of the works and grounds, prominent in which is the extension of the buildings for a third engine, the building of an additional coal shed, the taking down of No. 1 and rebuilding on a larger scale, the laying of an additional 42-inch main through the grounds, and the connecting of the Nos. 1, 2 and 3 engines thereto.

Prior to the building of the settling basin, the water in the river extended some distance beyond the north end of this basin. The greater part of this ground through which it is located was of a swaly or marshy nature. In the construction of this basin, it was necessary to build, on three sides of it, walls of piles and sheet piling, to sustain the walls of puddled clay, two rows of piles and sheet piling being driven for that purpose. The north and east walls have four rows of piles and puddle walls of clay eleven feet thick. The west wall or east dock has also four rows of piles and two rows of sheet piling, with wall of puddle clay fourteen feet thick. This dock has a width of twenty-five feet, and is the dividing wall between the canal and settling basin. The south wall of the basin is the natural river bank, having a width at the ground line of 200 feet. The basin, as it now is, has a width of 350 feet, and an average length of 826 feet at the high-water line, and a depth varying from twelve to sixteen feet; its total capacity when at the high-water line, is about thirty-one million U. S. gallons.

This basin when built had but one influent and effluent pipe and conduit, and two gate and crib houses, the lower part of which were submerged in the basin. Since this, two additional influent and one effluent pipe and conduits have been added, having a direct connection to and from the basin; and, in addition to these, an independent line of conduit and influent pipe has also been added. This has a joint purpose of influent and effluent, and can be used with or without the settling basin. This is our side pass, running along the east side of the basin, the purport of which is, to take the place of said basin, when for any cause, it may need pumping out. There are two branch connections from this side pass, one near the south end and the other north of the basin.

This side pass has an inner diameter of six feet, and a total length of pipe and conduit of 2,656 feet, gate and strainer wells intersect this line.

One of the influent conduits connecting direct to the basin, is built near the surface of the river and grounds; this is designated surface inlet, and is only used as occasion may require, when anchor ice is causing trouble by clogging the strainer at the intake of the influent pipe, and is an efficient auxiliary to our influent pipe.

Two of the influent pipes extend from the shore line out in the river 1,505 feet, and one 1,030 feet, and are submerged at their intake in twenty-five feet of water. Their diameters are five and six feet, and in twenty-five foot lengths. The pipes are made of boiler-plate, with flexible joints; lugs of wrought iron are rivetted on either side through the axes of the pipe, and held together with large joint-bolts. The flexible joints allowing the pipe to conform to the bed of the river, piles are driven at each joint and around the strainer boxes, and through the trench in the deep cutting two piles were driven at each joint, one on either side, and a saddle of 6 x 12 inch oak timber bolted to the piles, to prevent the pipe from raising, either from the back filling or the washings from the river, experience having taught us this precaution.

The effluent gate and crib-house at the north end of the basin, have been abandoned as such, and two brick gates and strainer wells were built to take its place, and were built one on either side of said conduit, about 50 feet apart centres; four branch connections were built from the wells, connecting with this conduit, and at the intersection of these branches with the main line, two well-holes were built, connecting the branches and the main together, the flow of the water passing through the branches to and from the wells, and are so arranged with shut-off gates, that the wells may be used together or separately. The wells have an inner diameter of eighteen feet and a depth of twenty-one feet, with five-foot openings.

Since building the settling basin, the piles and sheet-piling have been cut down to about 6 feet below high water line, and the admixture of earth and clay filling above this point to the ground level, graded off to a gradual slope of about 3½ to 1. The surplus earth was deposited inside the basin in front of the sheet piling, making a back support to the same. All the grounds east and north of the basin having been thoroughly filled in, and having had some 10 years to settle, has added solidity to the embankments. The sloping banks of the basin were sodded above high water line, and below this point covered with stone chips and fine gravel. The improvement to the appearance of the basin was very marked by this change, the piles and sheet piling had become very much disfigured with age and decay, and were very unsightly. While doing this work the water in the basin was lowered some 6 feet by partly closing the influent gates. The west wall or dividing dock between the basin and canal stands the same as when first built. This dock extends about 750 feet beyond the south end of the basin, and 300 feet north of the same, making a total length of 1,900 feet. Just west of this dock is a canal 45 feet wide between the walls of piles and sheet piling, and 17 feet deep. Coal and other supplies are brought to the works through this canal. The west side of said canal has been cut down in a similar manner as the walls inside the basin, and the earth graded off, the sloping bank sodded and graveled.

The entire grounds to the end of the dock covers an area of 60 acres, with a width of 967 feet, and a length of 2,700 feet, and a frontage on Jefferson Avenue conforming to the angle of the avenue of 1,016 feet.

In closing this report it is only courteous to say that the help in the office of my department has been very efficient and the co-operation with the other departments very harmonious.

Transmitted with this report are the locations of the pipes, mains and gates, also inventory of pipe, special castings, and tools on hand to January 2, 1892.

I also submit a sketch of the Pumping Works grounds, and its adjuncts, showing the general lay of the settling basin, with its influents and effluents, and the main pipeage. (For particular in detail see sketch.)

HENRY BRIDGE,
Superintendent of Extension and Construction.

PIPEAGE OF THE CITY OF DETROIT,

ALPHABETED BY STREETS, SHOWING THE KIND AND SIZE OF THE IRON AND WOOD PIPE NOW IN USE.

LOCATION.	DIAM. INCHES.	KIND.
A st., from Vinewood to Hubbard	4	iron.
Aberle ave., crossing Russell e. side	4	"
Abbott st., from Cass to Tenth	24	"
" alley s. of, from Cass to w. line of Lognon farm	4	"
" alley s. of, crossing Sixth	6	"
" alley n. of, from First to Twelfth	4	"
Adair st., from 424 ft. s. of Wight to Jefferson	4	"
Adams ave., from John R to Randolph	6	"
" from Witherell to Hastings	4	"
" alley s. of, from 240 ft. e. of Clifford to Cass	4	"
" alley n. of, from Woodward to 100 ft. w. of Cass	4	"
Adelaide st., from Woodward to St. Antoine	4	"
" from St. Antoine to Hastings	2¼	wood.
" from Hastings to Orleans	4	iron.
" e. from Orleans 36 ft	18	"
" from Orleans to Gratiot	10	"
Agnes ave., from Field to E. Boulevard	4	"
" w. from Crane 215 ft	4	"
Alexandrine ave., from Woodward to Cass	6	"
" from Cass to Third	4	"
" w. from Fourth 150 ft	3	"
" e. from Crawford 430 ft	4	"
" from Sixth to Seventh	4	"
" from alley w. of Trumbull to alley w. of Commonwealth	4	"
" from Woodward to w. line of Brush farm	4	"
" w. from Beaubien 195 ft	4	"
" from Beaubien to St. Antoine	3	"
" from St. Antoine to Rivard	3	wood.
" from Rivard to Russell	2¼	"
" crossing St. Antoine and Hastings	4	iron.
" from Russell to alley w. of Dubois	4	"
" from alley w. of Dubois to 63 ft. e. of Chene	3	"
" crossing Chene	4	"
" from 63 ft. e. of Chene to w. line of Grandy	3	wood.
" crossing Grandy	3	iron.
" from alley e. of McDougall to 401 ft. e. of Moran	4	"
Alfred st., from Woodward to Russell	4	"
" from Russell to Orleans	3	"
" from Orleans to Dubois	4	"
Alger ave., from 16 in. main to e. line of Woodward	6	"
" e. from Woodward 514 ft	4	"
Amherst st., w. from Junction 314 ft	4	"
Amsterdam st., crossing Cass	4	"
Annexation st., e. from Junction 558 ft	4	"

LOCATION.	DIAM. INCHES.	KIND.
Anthon st., w. from Junction 409 ft	4	iron.
Antietam st., from Rivard to 22 ft. w. of McDougall	4	“
Antoinette ave., crossing Cass and Second	4	“
“ e. from Second 165 ft	3	“
“ w. from Twelfth 193 ft	4	“
“ w. from Wabash 138 ft	4	“
Arndt st., from Gratiot to 275 ft. e. of Jos. Campau	2¼	wood.
“ crossing Jos. Campau	4	iron.
“ from 275 ft. e. of Jos. Campau to alley w. of McDougall	3	“
“ from alley e. of McDougall to Elmwood	3	“
“ from Elmwood to Mt. Elliott	4	“
Artillery ave., crossing River and Fort	6	“
“ s. from Dix 477 ft	8	“
Ash st., from Grand River to alley e. of Trumbull	4	“
“ from alley w. of Trumbull to National	3	wood.
“ from Harrison to Twelfth	4	iron.
“ from Twelfth to alley e. of Wabash	2¼	wood.
“ w. from Wabash 148 ft	4	iron.
“ crossing Fifteenth and Sixteenth	4	“
“ from Sixteenth to Seventeenth	4	“
“ from Seventeenth to Eighteenth	3	“
“ crossing Eighteenth to alley w. of	4	“
“ e. from Humboldt 166 ft	3	“
“ from Humboldt to Sullivan	4	“
“ w. from Sullivan 214 ft	3	“
“ e. from Maybury 250 ft.	4	“
“ from Tillman to Twenty-fourth	4	“
“ crossing Tillman and Twenty-fourth	4	“
“ from Twenty-seventh to Vinewood	4	“
Atwater st., from Griswold to Shelby	3	“
“ from Griswold to Bates	6	“
“ from Randolph to 215 ft. e. of St. Aubin	4	“
“ from 215 ft. e. of St. Aubin to McDougall	6	“
“ alley s. of, from alley w. of Bates to Randolph	4	“
Aurelia st., w. from Twelfth 180 ft	4	“
B st., w. from Vinewood 313 ft	4	“
Bagg st., from Woodward to Fifteenth	24	“
“ from Fifth to Crawford	3	“
“ crossing Crawford e	4	“
Bagley ave., from Park to Clifford	4	“
“ alley e. of, from alley n. of Park to Cass	4	“
“ alley w. of, from 230 ft. n. of Clifford to Grand River	4	“
Baker st., from Seventh to Twenty-fourth	8	“
“ from Seventh to Eighth	4	“
“ from Twenty-fourth to Vinewood	4	“
“ crossing Twenty-fifth and Vinewood e. 29 ft	6	“
“ from Hubbard to Scotten	4	“
“ alley s. of, from Wabash to Fourteenth	4	“
Baldwin ave., from Jefferson to Kercheval	6	“
“ from Mack to Warren	10	“
Baltimore ave., from Woodward to Crawford	4	“
“ from Woodward to Brush	3	“
Bates st., from Atwater to Farmer	6	“
“ from Congress to Champlain	30	“
Beacon st., from Brush to 211 ft. e. of St. Antoine	4	“
Beaubien st., from Atwater to Clinton	6	“

LOCATION.	DIAM. INCHES.	KIND.
Beaubien st., crossing Champlain	8	iron.
“ from Clinton to Watson	4	“
“ from Watson to Harper	10	“
“ from Harper to s. line N. Boulevard	6	“
“ from s. line of N. Boulevard to 24 inch main	10	“
Beaufait ave., n. from Jefferson 585 ft	6	“
“ from 585 ft. n. of Jefferson to 282 ft. n. of St. Paul	4	“
“ from 282 ft. n. of St. Paul to 263 ft. n. of Kercheval	6	“
“ from Mack to 295 ft. s. of Gratiot	6	“
“ from Gratiot to 190 ft. n. of Forest	6	“
Beaver st., from Vinewood to 28 ft. w. of Twenty-seventh	4	“
Beech st., from First to Seventh	4	“
Bellair st., from Riopelle to St. Aubin	2¼	wood.
“ e. from St. Aubin 300 ft	4	iron.
“ w. from Dubois 100 ft	3	“
“ crossing Dubois and Chene	4	“
“ from Dubois to Grandy	3	“
“ from Grandy to Jos. Campau	2¼	wood.
“ e. from McDougall 409 ft	4	iron.
Belle Isle ave., from Parker to 250 ft. n. of Coe	6	“
Bellevue ave., from Jefferson to 361 ft. n. of Berlin	6	“
“ from Mack to s. line of Superior	6	“
“ crossing Gratiot	6	“
“ from Gratiot to 30 ft. s. of Farnsworth	4	“
Belmont ave., from 16 inch main to e. line Woodward	6	“
Benton st., from Brush to Russell	4	“
Berlin st., from Gratiot to Jos. Campau	3	“
“ from Jos. Campau to alley w. of McDougall	2¼	wood.
“ crossing Jos. Campau and Elmwood	4	iron.
“ from alley e. of McDougall to Elmwood	3	“
“ from Ellery to Mt. Elliott	4	“
Biddle st., from Twenty-seventh to 190 ft. e. of Vinewood	4	“
Blaine ave., from 16 inch main to w. line of Woodward	6	“
“ w. from Woodward 1568 ft	4	“
Boone st., crossing Collins	6	“
“ w. from Collins 314 ft	4	“
Boulevard East, e. side, from 255 ft. s. of Jefferson to Congress	6	“
“ e. side, s. from Agnes 121 ft	6	“
“ w. side, from Jefferson ave. main to n. line	6	“
“ w. side, n. from St. Paul 52 ft	6	“
“ both sides, crossing Mack	4	“
“ e. side, crossing Gratiot s	4	“
“ Frontenac, s. from Medbury 93 ft	6	“
Boulevard North, from Collins to 456 ft. w. of Sullivan	24	“
“ n. side, crossing Woodward	6	“
“ s. side, crossing Cass, Twelfth and Fourteenth	4	“
“ s. side, w. from Twelfth 361 ft	4	“
“ s. side, from e. line of Grand River to e. line of W. Boulevard	4	“
“ n. side, e. from Grand River 600 ft	4	“
“ s. side, Woodward to w. line of G. T. Ry	4	“
Boulevard West, e. side, s. from N. Boulevard 161 ft	4	“
“ from Myrtle to Visgar	6	“
“ from Baker to Shady lane	3	“
“ w. side, from Shady lane to Porter	4	“
“ w. side, n. from Fort st. main 40 ft	4	“

LOCATION.	DIAM. INCHES.	KIND.
Boulevard West, e. side, from Shady lane to 560 ft. s. of Porter	4	iron.
" e. side, n. from Fort st. main 44 ft	4	"
Bowen pl., from Woodward to Cass	4	"
Brady st., from Woodward to Beaubien	6	"
" from Beaubien to Russell	4	"
Brainard st., from Cass to Third	4	"
" from Third to alley w. of	2¼	wood.
" from Fourth to alley w. of	4	iron.
" from alley w. of Fourth to Crawford	3	"
" from Sixth to Seventh	4	"
Brandon ave., from Hubbard to Junction	4	"
Bratshaw st., from Third to Fourth	2¼	wood.
Breckenridge st., w. from Fourteenth 140 ft	4	iron.
" from 143 ft. e. of Seventeenth to Eighteenth	4	"
Brevoort pl., e. from Nineteenth 284 ft	4	"
" crossing Twenty-second	4	"
" e. from Twenty-second 240 ft	2¼	wood.
Brewster st., from Brush to Russell	4	iron.
" from Riopelle to Gratiot	4	"
Brigham st., from Third to Grand River	30	"
" from Fourth to Eighth	4	"
" crossing Lincoln and Twelfth	4	"
" e. from Twelfth 196 ft	4	"
Bristol pl., from Twenty-first to Twenty-second	4	"
Brush st., from Atwater to Jefferson	6	iron.
" from Jefferson to Congress	4	"
" from Congress to Gratiot	8	"
" from Gratiot to Wilkins	4	"
" from Edmund to Watson	24	"
" from Watson to Benton	6	"
" crossing Eliot and Rowena	4	"
" n. from Baltimore 280 ft	3	"
" from 280 ft. n. of Baltimore to 251 ft. n. of Milwaukee	4	"
" from s. line of N. Boulevard to 24 inch main	8	"
" from Horton to Hamlin	4	"
Bryant st., w. from Twelfth 132 ft	2¼	wood.
Buchanan st., from Grand River to Vinewood	30	iron.
" w. from Wabash 172 ft	4	"
" from Fourteenth to Fifteenth	4	"
" w. from Seventeenth 169 ft	4	"
" Eighteenth to 387 ft. w. of Humboldt	4	"
" from 75 ft. e. of Sullivan to Williams	4	"
" from Twenty-third to w. line Twenty-fourth	4	"
" from 87 ft. e. of Scotten to Twenty-ninth	4	"
" from Twenty-eighth s. to Twenty-eighth n. 70 ft	6	"
" Campbell to Wesson	4	"
" alley s. of, from Joe to Howell	6	"
Bushey st., from Michigan to Julia	6	"
Butternut st., from Seventh to alley e. of Trumbull	4	"
" from alley w. of Trumbull to National	4	"
" e. from Wabash 263 ft	4	"
" e. from Seventeenth 144 ft	4	"
" e from Maybury 227 ft	4	"
" from Fifteenth to Twenty-fourth	24	"
C st., from Vinewood to Hubbard	4	"
adillac ave., from Pumping Works to Mack	42	"

LOCATION.	DIAM. INCHES.	KIND.
Cadillac ave., from 1,000 ft. to 2,050 ft. n. of Jefferson	6	iron.
Cadillac square, s. side, from Woodward to Randolph	24	"
" n. side, from Monroe to Bates	6	"
" alley n. of, from alley w. of Bates to Randolph	4	"
Calhoun st., from Brush to Russell	4	"
" w. from Riopelle, 159 ft	4	"
" from Dequindre to Dubois	2¼	wood.
" crossing St. Aubin	4	iron.
" from w. line of Dubois to e. line of Chene	4	"
" e. from Chene, 806 ft	2¼	wood.
" from 806 ft. e. of Chene to Grandy	8	iron.
Campau st., from River to Fort	6	"
" n. from Dix 448 ft	4	"
Campbell ave., from River to Driggs	6	"
" from 894 ft. s. of Fort to Celeron	6	"
" crossing Dix	6	"
" from Romeyn to Annexation	6	"
" from Jackson to 161 ft. n. of Herbert	6	"
Canfield ave., from Woodward to Third	30	"
" from Woodward to Third	4	"
" from Fourth to Crawford	4	"
" from Sixth to Seventh	8	"
" from Twelfth to 48 ft. e. of Thirteenth	8	"
" e. from Thirteenth 48 ft	4	"
" from Woodward to Collins	42	"
" from Woodward to Collins	6	"
" w. from Mt. Elliott 767 ft	4	"
" alley s. of; e. from Hastings 831 ft	8	"
" alley n. of; e. from Second 150 ft	8	"
" alley n. of; e. from Hastings 835 ft	8	"
Caniff ave., crossing Woodward	6	"
" w. from Woodward 27 ft	4	"
Canton ave., from Jefferson to 210 ft. n. of Kercheval	6	"
" crossing Mack	6	"
" from 95 ft. s. of, to 118 ft. n. of Farnsworth	6	"
Caroline st., w. from Twelfth 192 ft	8 & 4	"
Cass st., from Woodbridge to Jefferson	8	"
" from Jefferson to Congress	24	"
" from alley n. of Congress to Fort	24	"
" from alley n. of Michigan to Spencer	4	"
" alley w. of, from alley n. of Adams, to 119 ft. s. of Gilman	4	"
" alley w. of, s. from Gilman 119 ft	8	"
Cass ave., alley w. of, from Ledyard to Bagg	2¼	wood.
Cass st. and ave., from Jefferson to Joy	10	iron.
Cass ave., from Joy to Alexandrine	8	"
" crossing Canfield	8	"
" from Alexandrine to 118 ft. s. of D. and B. C. R. R	6	"
" from 118 ft. s. of D. and B. C. R. R. to Milwaukee	8	"
" from 24-in. main to s. line of N. Boulevard	8	"
" w. side crossing Putnam	4	"
Catherine st., from Gratiot to Rivard	4	"
" crossing Rivard	6	"
" from Rivard to Dequindre	4	"
" from Dequindre to St. Aubin	8	"
" from St. Aubin to Elmwood	4	"
Cavalry ave., from 188 ft. s. of Cadet to n. line of Dix	6	"

LOCATION.	DIAM. INCHES.	KIND.
Cavalry ave., from Dix to Toledo	4	iron.
Celeron st., from Junction to 274 ft. w. of Campbell	4	“
Celia st., from Twelfth to Thirteenth	4	“
“ from Thirteenth to Wabash	3	“
Champlain st., from Randolph to St. Aubin	30	“
“ from Randolph to alley e. of	4	“
“ from St. Antoine to Orleans	4	“
“ from Orleans to Elmwood	6	“
“ from Elmwood to 250 ft. w. of Leib	4	“
“ w. from Leib 250 ft	3	“
“ from Leib to Field	4	“
“ w. from Crane 238 ft	4	“
“ alley n. of, from Brush to St. Antoine	4	“
Chandler ave., from 16-in. main to e. line of Woodward	6	“
Charles J. ave., from Holcomb to McClellan	4	“
Charles st., from Sixth to Seventh	4	“
Charlevoix st., from Chene to e. line of Jos. Campau	4	“
“ from Jos. Campau to alley w. McDougall	3	“
“ from alley e. of McDougall to Elmwood	4	“
“ w. from Mt. Elliott 217 feet	4	“
Charlotte ave., from Woodward to alley e. of Third	4	“
“ w. from Fourth 131 feet	3	“
“ e. from Fifth 180 ft	4	“
Chase st., from alley e. of Russell to Riopelle	3	“
“ crossing Riopelle w	4	“
Chene st., from Atwater to 131 ft. s. of Hendrie	6	“
“ from 136 ft. s. of Medbury to Harper	6	“
“ from Piquette to Trombly	6	“
“ from Congress to Canfield	30	“
Cherry st., from Grand River to alley w. of Trumbull	4	“
“ from alley w. of Trumbull to National	3	“
“ from Harrison to Twelfth	4	“
Chestnut st., from Russell to Elmwood	4	“
Chipman st., from Nineteenth to alley w. of Eighteenth	4	“
Chope pl., s. from Grand River 167 ft	4	“
Christiancy st., e. from Lansing 134 ft	4	“
Church st., crossing Tenth to 170 ft. w	4	“
“ alley s. of, from Eighth to Tenth	4	“
Clairmont ave., from 16-in. main to w. line of Woodward	6	“
“ w. from Woodward 1,275 ft	4	“
Clark ave., from River to Fort	8	“
“ from 1,000 ft. n. of Fort to s. line of M. C. R. R	8	“
“ from s. line of M. C. R. R. to Michigan	6	“
“ from Michigan Car Works to Michigan	4	“
“ in Car Works grounds	6	“
Clark Park, w. from Scotten 292 ft	4	“
“ e. from Clark ave. 282 ft	4	“
Cleveland pl., crossing Crawford	4	“
“ from Crawford to alley w. of Fourth	3	“
Cleveland st., e. from St. Aubin 176 ft	4	“
“ from 273 w. of Dubois to Chene	2¼	wood.
“ e. from Chene 377 ft	3	“
“ from 377 ft. e. of, to 582 ft. e. of Chene	2¼	“
“ from 314 ft. w. of, to e. line of Jos. Campau	4	iron.
“ e. from Jos. Campau 400 ft	3	“
“ from alley e. of McDougall to Elmwood	4	“

LOCATION.	DIAM. INCHES.	KIND.
Cleveland st., e. from Elmwood 650 ft	3	iron.
" from 650 ft. e. of Elmwood to w. line Burlage pl	4	"
Cleveland ave., from e. to w. line of Woodward	6	"
Clifford st.. from e. line of Woodward to Washington	12	"
" from alley w. of Griswold to e. line of Washington	4	"
" from Park pl. to Sproat	4	"
Clinton ave., from Gratiot to Rivard	10	"
" Rivard to Orleans	16	"
" Orleans to Elmwood	8	"
" w from Crane 211 ft	4	"
Coe ave., from Vandyke to Belle Isle	6	"
Colby ave., crossing Russell, e. side	4	"
Collins st., from Gratiot to Canfield	42	"
" from Canfield to Griffin	30	"
" from Leland to Canfield	4	"
" n. from Canfield 563 ft	3	"
" from 563 feet n. of Canfield to 26 ft n. of Hancock	4	"
" s. from Harper 150 ft	6	"
Columbia st., from Woodward to Cass	4	"
" from Woodward to John R	6	"
" from John R, to Beaubien	4	"
" from Beaubien to Rivard	6	"
" alley s. of, from Woodward to Cass	6	"
Columbus ave., s. from Fort 570 ft	3	"
" crossing Fort	4	"
Commonwealth ave., crossing Putnam to 168 ft. n. of	6	"
" from Kirby to 7 ft. n. of Stanley	6	"
" s. from Holden 214 ft	6	"
Company ave., from 67 ft. s. of, to 307 ft. n. of Lorman	6	"
Concord ave., from Jefferson to 110 ft. n. of Waterloo	6	"
" from 320 ft. s. of Charlevoix to Mack	6	"
" from 90 ft. s. of Canfield to 168 ft. n. of Hancock	6	"
Congress st., from Bates to Sixth	30	"
" from Randolph to St. Aubin	24	"
" from St. Aubin to Meldrum	42	"
" from Bates to Brush	4	"
" from St. Antoine to Mt. Elliott	4	"
" w. from Helen 171 ft	4	"
" from e. line of E. Boulevard to Field	4	"
" alley s. of, from Griswold to Third	4	"
" alley s. of, e. from Fourth 250 ft	4	"
" alley s. of, from Sixth to Seventh	4	"
" alley s. of, from 80 ft. e. of Brush to St. Antoine	4	"
" alley n. of, from alley w. of Woodward to Shelby	4	"
" alley n. of, from Shelby to Cass	6	"
" alley n. of, from Cass to 10 ft. w. of Third	4	"
" alley n. of, from Fifth to Seventh	8	"
" alley n. of, from Seventh to Eighth	4	"
" alley n. of, from alley e. of Woodward to 94 ft. e	3	"
" alley n. of, from alley e. of Woodward to Bates	4	"
" alley n. of, from alley w. of Brush to St. Antoine	4	"
Craig ave., n. from Trombly 378 ft	3	"
Crane ave., from Jefferson ave. main to Mack	8	"
Crawford st., from Bagg to Lothrop	6	"
" n. from Lothrop 3984 ft	4	"
" crossing Brigham	8	"

LOCATION.	DIAM. INCHES.	KIND.
Crawford st., crossing N. Boulevard	10	iron.
Cross st., alley n. of, from John R. to Randolph	4	"
Crystal st., from Trombly to Milwaukee	4	"
Custer ave., e. from Woodward 298 ft	4	"
" e. from John R. 177 ft	4	"
" e. from Brush 215 ft	4	"
" from Oakland to Hastings	4	"
" w. from Jos. Campau 433 ft	4	"
D st., w. from Vinewood 300 ft	4	"
Dalzelle st., crossing Twelfth	4	"
" from Twelfth to Thirteenth	3	"
" from Foundry to Twenty-second	4	"
" from Twenty-third to Twenty-fourth	4	"
Dane st., crossing Collins e.	6	"
" from 320 ft. e. of Collins to 338 ft. e. of Moran	4	"
Davenport st., from Woodward to Cass	4	"
Davis pl., s. from Theodore 280 ft	2¼	wood.
Dequindre st., from Woodbridge to Jefferson	6	iron.
" w. side, from Jay to Waterloo	4	"
" e. side, from Waterloo to Gratiot	4	"
" s. from Adelaide 206 ft	4	"
" from Alfred to Pierce	4	"
" from Canfield to Willis	4	"
Division st., from Brush to St. Aubin	4	"
Dix ave., from Twenty-fourth to Artillery	10	"
Dragoon ave., n. from River 563 ft	6	"
" from s. line of Fort to Army	6	"
" from 85 ft. n. of Regular to n. line of Dix	6	"
Driggs ave., from Junction to Campbell	4	"
Dry-Dock st., from Swain to Lady's Lane	4	"
Dubois st., from Atwater to Clinton	6	"
" from Clinton to Hunt	8	"
" from Hunt to Leland	6	"
" from Leland to Canfield	3	"
" from Canfield to 188 ft. n. of Frederick	4	"
" from Ferry to 388 ft. n. of Palmer	4	"
" from 100 ft. s. of Medbury to Harper	4	"
" crossing N. Boulevard	8	"
Duffield st., from Woodward to Cass	4	"
Dumontier ave., e. from Crane 297 ft	4	"
Dunn st., e. from Wesson 160 ft	3	"
E st., w. from Vinewood 416 ft	4	"
" from Twenty-sixth to e. line of W. Boulevard	4	"
Edmund pl, from Woodward to Brush	24	"
Eighth st., from river to alley s of Fort	4	"
" from Fort to alley n. of	2¼	wood.
" from Baker to Michigan	3	iron.
" from Michigan to Cherry	4	"
" from Grand River to Lysander	4	"
" s. from Brigham 40 ft	6	"
Eighteenth st., from Fort to 50 ft. n. of Linden	6	"
" from 50 ft. n. of to 370 ft. n. of Linden	3	"
" from 370 ft. n. of to 468 ft. n. of Linden	4	"
" from 468 ft. n. of Linden to Buchanan	6	"
" from Buchanan to 369 ft. n. of Breckenridge	4	"
" from Grand River to 275 ft. n. of Kirby	6	"

LOCATION.	DIAM. INCHES.	KIND.
Eighteenth st., from 210 ft. s. of Stanley to s. line of N. Boulevard	6	iron
" from s. line of N. Boulevard to n. line	8	"
" alley w. of, n. from Porter 150 ft	3	wood.
" alley w. of, from Brevoort to Webster pl	4	iron.
" alley w. of, from St. Clair to Wing pl	4	"
" alley w. of, from Chipman to Johnson	4	"
Eighteenth-and-a-half st., from River 504 ft	3	"
" from River to Fort	4	"
Elizabeth st., n. and s. sides, from alley e. of Woodward to 200 ft. w. of Brush	4	"
" from 200 ft. w. of Brush to Hastings	4	"
" alley s. of, from alley e. of Woodward to Witherell	3	"
Ellery st., from Arndt to Berlin	6	"
" from Mack to Pulford	6	"
" from Zender to Gratiot	6	"
" from Forest to Hancock	3	"
Eliot st., from Woodward to Riopelle	4	"
Elm Grove ave., from Crane to Holcomb	4	"
Elm st., from Seventh to alley e. of Trumbull	4	"
" from alley w. of Trumbull to National	4	"
" from Harrison to alley e. of Wabash	4	"
Elmwood ave., from Jefferson to Monroe	4	"
" Monroe to Maple	6	"
" from Waterloo to Hunt	4	"
" from Hunt to Gratiot	6	"
Englewood ave., from 16-in. main to e. line of Woodward	6	"
" from e. line of Woodward to w. line of Oakland	4	"
Erskine st., from Woodward to Brush	4	"
Euclid ave., from 16-in. main to w. line of Woodward	6	"
Exposition Grounds, s. from River rd. 948 ft	4	"
F st., w. from Vinewood 140 ft	4	"
Farmer st., from Bates to Gratiot	6	"
" from 15 ft. s. to 38 ft. n. of 30-in. main in Gratiot	8	"
Farnsworth st., from Woodward to Beaubien	6	"
" from Beaubien to Russell	4	wood.
" from Russell to Grandy	4	iron.
" crossing Collins	6	"
" from Collins to Moran	3 & 4	"
" from Canton to Helen	4	"
" w. from Vandyke 301 ft	4	"
Ferdinand ave., n. from River 975 ft	4	"
" s. from Fort 480 ft	4	"
" from Porter to 116 ft. n. of Christiancy	6	"
" from 360 ft. s. to 309 ft. n. of Dix	6	"
Ferry ave., from Woodward to Russell	4	"
" from Russell to St. Aubin	8	"
" from St. Aubin to Mitchell	4	"
" crossing Collins	8	"
" w. from Moran 247 ft.	4	"
" w. from Vandyke 263 ft	4	"
" alley s. of, from alley w. of St. Aubin w. 168 ft	2¼	wood.
Field ave., from Jefferson to 1,558 ft. n. of Kercheval	6	iron.
" from 4 ft. s. of Mack to 177 ft. n. of Medbury	6	"
Fifth st., from Congress to alley n	8	"
" from alley s. of to alley n. of Lafayette	4	"
" from Labrosse to alley n. of.	4	"

LOCATION.	DIAM. INCHES.	KIND.
Fifth st., from Michigan to Noble, and on both sides of Elton and Crawford parks	4	iron.
Fifth ave., from Holden to 144 ft. s. of Piquette	4	"
" from 16-in. main to w. line of Woodward	6	"
" w. from Woodward 182 ft	4	"
Fifteenth st., from Fort to Grand River	6	"
" from Bagg to Buchanan	24	"
" n. from Warren 348 ft	6	"
" s. from 24-in. main in N. Boulevard 63 ft	6	"
First st., from Front to Jefferson	6	"
" from Jefferson to alley n. of	8	"
" crossing Congress	8	"
" Woodbridge to Fort	4	"
" Fort to Grand River	6	"
Fisher ave., from Jefferson to 118 ft. n of St. Paul	6	"
Fletcher st., w. from Wesson ave. 238 ft	4	"
Florence st., n. of Harper 124 ft	3	"
" from 124 ft. to 265 ft. n. of Harper	4	"
Flower st., n. from Forest ave. main 36 ft	4	"
" n. from Forest 260 ft	3	"
Forest ave., from Woodward to Cass	4	"
" n. and s. sides, from Cass to Third	4	"
" from Fourth to Seventh	4	"
" crossing Trumbull	4	"
" from National to 190 w. of Twelfth	4	"
" from Woodward to 324 w. of Rivard	4	"
" from Russell to 377 ft. e. of Chene	4	"
" w. from Grandy 225 ft	2¼	wood.
" crossing Collins	6	iron.
" from Collins to Moran	4	"
" from 124 ft. w. of Ellery to Mt. Elliott	4	"
" w. from Beaufait 157 ft	4	"
" alley n. of, crossing Orleans w. side	4	"
" alley n. of, from w. line of Orleans to alley e. of Riopelle	3	"
Fort st., from Woodward to Griswold	4	"
" from Woodward to Seventh	16	"
" from Seventh to Fourteenth	6	"
" from Fourteenth to Hoffman	8	"
" from Hoffman to Twenty-fourth	6	"
" from Twenty-fourth to Artillery	8	"
" from St. Antoine to Mt. Elliott	4	"
" w. from Helen 168 ft	4	"
" alley n. of, w. from Brush 135 ft	2¼	wood.
" alley n. of, from Brush to St. Antoine	4	iron.
Foundry st., from Baker to Michigan	6	"
Fourth st., from Woodbridge to Larned	4	"
" from Larned to Congress	8	"
" from Fort to Grand River	6	"
Fourth ave., from Grand River to Bagg	4	"
" from Bagg to Brigham	6	"
" from Brigham to Holden	4	"
" alley w. of, from Brainard to alley n. of	4	"
" alley w. of, from Selden to alley s. of	4	"
" from 16 inch main to w. line of Woodward	6	"
Fourteenth ave., from Fort to Lafayette	8	"
" w. side, n. from Porter 402 ft	4	"

LOCATION.	DIAM. INCHES.	KIND.
Fourteenth ave., from Lafayette to Bagg	10	iron.
" from Bagg to Grand River	8	"
" from Grand River to s. line of N. Boulevard	6	"
" crossing N. Boulevard to s. line	8	"
Fox st., from Frank to Alexandrine	3	"
" crossing Alexandrine	4	"
Frank st., from Fourth to 114 ft. w. of Sixth	4	"
" from 114 ft. w. of Sixth to alley e. of Seventh	3	"
Franklin st., from Randolph to Beaubien	4	"
" from Beaubien to Orleans	6	"
" from Orleans to 25 ft. e. of Dequindre	4	"
" from 25 ft. e. of Dequindre to McDougall	6	"
" from Walker to Adair	4	"
" crossing Leib w. side	4	"
" w. from Leib 310 ft	2¼	wood.
" alley s. of, from McDougall to Walker	4	iron.
" alley n. of, from McDougall to Walker	4	"
Frederick st., from Woodward to 178 ft. e. of Russell	4	"
" from 252 ft. w. of St. Aubin to alley w. of Dubois	4	"
" crossing Collins	6	"
" e. from Helen 124 ft.	4	"
" w. from Vandyke 265 ft.	4	"
Front st., from 170 ft. e. of First to Second	4	"
" e. from Third 107 ft.	6	"
" alley n. of, from Second to Third	4	"
Frontenac Boulevard, s. from Medbury 93 ft	6	"
Gallagher pl., from Crawford to alley w. of Fourth	4	"
Garfield ave., from Woodward to w. line of Brush farm	4	"
" from 255 ft. w. of Beaubien to e. line of St. Antoine	4	"
" w. from Hastings 359 ft	3	"
" from Hastings to Rivard	4	"
" from Russell to 47 ft. e. of Chene	4	"
" from 47 ft. e. of Chene to Grandy	3	wood.
" crossing Grandy	4	iron.
" crossing Collins	6	"
" w. from Beaufait 182 ft	4	"
" alley s. of, w. from Hastings 369 ft	4	"
Gilbert st. e. from Scotten 368 ft	4	"
Gilman st., from Cass to Grand River	4	"
Gladstone ave., from 16-in. main to w. line of Woodward	6	"
" crossing Vinewood e. side	4	"
Glynn court, from 16-in. main to w. line of Woodward	6	"
" w. from Woodward 300 ft	4	"
Goethe st., e. from McClellan 228 ft	4	"
Goldner ave., from Michigan to G. T. Ry	6	"
Grand River ave., from Woodward to Cass	8	"
" from Cass to Third	6	"
" from Third to 400 ft. w. of Humboldt	8	"
" from 400 w. of Humboldt to city limits	6	"
" from Brigham to Buchanan	30	"
" connecting 8-in. to 30-in. in Buchanan 22 ft	8	"
" s. side, from Second to 56 ft. e. of Cherry	4	"
" n. side, e. from Eighth 110 ft	3	"
" alley n. of, w. from Lincoln 47 ft	4	"
" alley n. of, from 47 ft. w. of Lincoln to alley w. of	2¼	wood.
" alley n. of, from Trumbull to alley w. of	6	iron.

LOCATION.	DIAM. INCHES.	KIND.
Grandy ave., from Gratiot to Pierce	4	iron.
" from Pierce to Harper	6	"
" n. from Harper 322 ft	4	"
" from 332 ft. n. of Harper to 185 ft. n. of Trombly	6	"
Grant court, n. from Warren 313 ft	4	"
Grant st., crossing Twelfth	4	"
" from Twelfth to Thirteenth	3	"
Granville st., from Thirteenth to Wabash	3	"
" crossing Wabash	4	"
Gratiot ave., from Woodward to Brush	10	"
" from Woodward to Raynor	30	"
" from Brush to 64 ft. w. of Sheridan	6	"
" from 64 ft. w. of Sheridan to 266 ft. w. of Butler	8	"
" w. from Butler 266 ft	6	"
Green ave., from Holden to Milwaukee	6	"
" s. from 24-in. main in N. Boulevard 87 ft	6	"
Griffin ave., e. from Mitchell 68 ft	4	"
Griswold st., from Atwater to State	6	"
" s. from 12-in. main in Clifford 60 ft	10	"
" from Detroit River to Atwater	3	"
Guoin st., from e. line of Mullett Farm to Orleans	4	"
" from Orleans to 230 ft. e. of St. Aubin	3	"
" from 230 ft. e. of St. Aubin to Dubois	4	"
" from Chene to Jos. Campau	4	"
" from Jos. Campau to Walker	6	"
Haigh ave., from 16-in. main to e. line of Woodward	6	"
" e. from Woodward 158 ft	4	"
Hale st., crossing Riopelle	4	"
" from Riopelle to 300 ft. w. of St. Aubin	2¼	wood.
" w. from St. Aubin 300 ft	3	"
" crossing St. Aubin to 275 ft. e	4	iron.
" w. from Dubois 162 ft	3	"
" from Dubois to Chene	4	"
" from Chene to Grandy	3	"
" from Grandy to Jos. Campau	2¼	wood.
Hamlin ave., from Woodward to Oakland	4	iron.
Hammond ave., from Toledo to s. line of L. S. R. R	6	"
" from 356 ft. s. of Leavitte to 175 ft. n. of Ranspach	6	"
" s. from Horatio 956 ft	6	"
Hancock ave., from Cass to 112 ft. e. of Riopelle	4	"
" from St. Aubin to Dubois	4	"
" from 281 ft. w. of Chene to Grandy	4	"
" crossing Mitchell to 235 ft. e	4	"
" crossing Collins	6	"
" from Collins to Moran	4	"
" from alley w. of Ellery pl. to alley w. of Mt. Elliott	4	"
" from Fourth to w. line of Trumbull	4	"
" from National to 130 ft. w. of Thirteenth	4	"
" from Wabash to Fourteenth	3	"
" crossing Fourteenth	4	"
" from e. line of Twenty-fourth to Twenty-fifth	4	"
" from Twenty-seventh to w. line of Vinewood	4	"
" from LaSalle to Scotten	4	"
Hanover ave., crossing Russell e. side	4	"
Harmon ave., from 16 in. main to e. line of Woodward	6	"
" from e, line of Woodward to Oakland	4	"

LOCATION.	DIAM. INCHES.	KIND.
Harper ave., from Woodward to Russell	4	iron.
" from Widman pl. to 184 e. of Dubois	4	"
" e. from Chene 147 ft	4	"
" from 147 ft. e. of Chene to w. line of Grandy	2¼	wood.
" from w. line of Grandy to e. line of Mitchell	4	iron.
" from w. line of Collins to Moran	6	"
" w. from Twelfth 176 ft	4	"
" w. from Fourteenth 134 ft	4	"
Harrison ave., from Michigan to Grand River	4	"
" from Merrick to 343 ft. n. of Kirby	4	"
" alley w. of, from Linden s. to Linden n.	4	"
Harvey ave., from Junction to 500 ft. w. of Campbell	4	"
Hastings st., from 16 in. main to s. line of Jefferson	16	"
" from Jefferson to Champlain	24	"
" from Congress to Clinton	6	"
" from 118 ft. s. of Congress to Fort	3	"
" from Champlain to Monroe	3	"
" from Clinton to Catherine	4	"
" from Catherine to Watson	6	"
" from Watson to Canfield	10	"
" from Canfield to n. line of Warren	8	"
" crossing Theodore	8	"
" from Farnsworth to Ferry	6	"
" from Harper to Piquette	6	"
" from Piquette to s. line of N. Boulevard	4	"
" from 24 in. main to s. line of N. Boulevard	8	"
" from N. Boulevard to Custer	4	"
" s. from Pallister 266 ft	6	"
" alley w. of, s. from Custer 26 ft	4	"
" alley w. of, from 26 ft. s. of Custer to N. Boulevard	3	"
Hazel st., from Harrison to 156 ft. w. of Twelfth	4	"
" from 156 ft. w. of Twelfth to 96 ft. e. of Thirteenth	3	"
" e. from Thirteenth 96 ft	4	"
Haselwood ave., from 16 in. main to w. line of Woodward	6	"
" from w. line of Woodward to Auburndale	4	"
Heck pl., crossing Forest	4	"
" from Forest to Hancock	3	"
Heidelberg st., crossing Jos. Campau	4	"
" e from Jos. Campau 270 ft	2¼	wood.
" from 270 ft. to 445 ft. e. of Jos. Campau	3	iron.
" from alley e. of McDougall to Elmwood	3	"
" crossing Elmwood w. side 39 ft	4	"
Helen ave., from Jefferson to Monroe	6	"
" from Gratiot to 132 ft. n. of Medbury	6	"
" crossing Mack	6	"
Hendricks st., from St. Aubin to Dubois	3	"
" from Dubois to alley w. of McDougall	4	"
" from alley e. of McDougall to Elmwood	4	"
" w. from Mt. Elliott 186 ft.	4	"
Hendrie ave., from Woodward to 550 ft. e. of John R.	4	"
" from e. line of Grandy to 408 w. of	4	"
" from Mitchell to e. line of McDougall	6	"
" w. from Vandyke 219 ft	4	"
Henry st., from Woodward to Clifford	4	"
" from Cass to Third	6	"
" from Third to alley e. of	4	"

LOCATION.	DIAM. INCHES.	KIND.
Herbert st., from Scotten to 134 ft. w. of Lovett	4	iron.
Hibbard ave., from Jefferson to 202 ft. n. of Brinket.	6	"
High st., from Grand River to Beaubien	4	"
" from Beaubien to A. Beaubien farm, w. line	3	"
" from w. line of A. Beaubien farm to Russell	4	"
" from Russell to Riopelle	3	"
" from Grand River to Fourth	3	"
" from Fourth to alley w. of Trumbull	4	"
" from alley w. of Trumbull to National	3	"
Hoffman st., from River to Fort,	8	"
Holbrook road, from 16-in. main to e. line of Woodward	6	"
Holcomb ave., from Jefferson to Lorman	6	"
" from Elm Grove to alley s. of Mack	6	"
Holden ave., from Woodward to w. line of Second	6	"
" from w. line of Second to Third	3	wood.
" from Third to Fourth	4	iron.
" from Fourth to Crawford	3	wood.
" from Crawford to Commonwealth	4	iron.
" s. from 24-in. main in N. Boulevard 95 ft	10	"
Hooker ave., n. from Grand River 63 ft	4	"
" w. from Eighteenth 596 ft	4	"
Horatio st., from Hammond to Welch	6	"
" from Welch to Livernois	4	"
Horton ave., from Woodward to Oakland	4	"
Howard st., from Tenth to Twelfth	4	"
" from M. C. R. R. Bridge to Twenty-fourth	6	"
" from Twenty-fourth to Twenty-fifth	4	"
" e. from Scotten 354 ft.	4	"
" w. from Junction 271 ft.	4	"
Howell st., from Buchanan to alley s. of	6	"
Hubbard ave., from Fort to 335 ft. n. of Brandon	6	"
" from E to Michigan	4	"
" from Michigan to Visgar	6	"
Hudson ave., w. from Crawford 564 ft	4	"
" from Maybury to Twenty-third	4	"
" from Twenty-sixth to e. line of Vinewood	4	"
Humboldt ave., from Michigan to Butternut	4	"
" crossing Butternut and Buchanan	6	"
" from Butternut to s. line of D. & B. C. R. R	4	"
" from Grand River to McGraw	6	"
Hunt st., from Dubois to alley w. of McDougall	4	"
" from alley e. of McDougall to Elmwood	4	"
" from 15 ft. e. of Ellery to Mt. Elliott	4	"
Huron st., s. from Locust 295 ft.	3	"
" from Locust to Bagg	2¼	wood.
Illinois st., w. from Beaubien 270 ft	2¼	"
" from 270 ft. w. of, to 594 w. of Beaubien	3	iron.
" crossing Beaubien, St. Antoine and Hastings	4	"
" from Beaubien to Russell	2¼	wood.
" from Russell to St. Aubin	4	iron.
" crossing Russell and St. Aubin	4	"
" from St. Aubin to Grandy	3	"
" crossing Dubois and Chene	4	"
" from Grandy to Jos. Campau	2¼	wood.
" e. from McDougall 241 ft	3	iron.
" from 241 ft. e. of to 421 ft. e. of McDougall	4	"

LOCATION.	DIAM. INCHES.	KIND.
Illinois st., w. from Moran 198 ft	4	iron.
Indiana st., from Beaubien to St. Antoine	8	wood.
“ crossing St. Antoine and Hastings	4	iron.
“ from St. Antoine to Rivard	2¼	wood.
“ crossing Rivard and Russell	4	iron.
“ from Rivard to Russell	8	wood.
Ingersoll st., e. from Wesson 296 ft	4	iron.
Iron st., from Wight to Jefferson	6	“
Irving ave., from Auburndale to 478 ft. w. of Seventh	4	“
Irving st., from Crawford to Seventh	4	“
Jackson st., from Scotten to Lovett	4	“
“ from Twenty-eighth to Twenty-ninth	4	“
Jay st., from Riopelle to 44 ft. w. of McDougall	4	“
Jefferson ave., from Griswold to Orleans	10	“
“ from Second to Hastings	16	“
“ from Dequindre to M. C. R. R. belt line	6	“
“ from M. C. R. R. belt line to McClellan	6	“
“ from Meldrum to Pumping Works	42	“
“ from Griswold to First	8	“
“ alley s. of, from alley w. of Woodward to alley w. of Griswold	4	“
“ alley s. of, from Shelby to Cass	4	“
“ alley s. of, from alley w. of Bates to Randolph	4	“
“ alley s. of, from Brush to Beaubien	8	“
“ alley s. of, e. from Beaubien 189 ft	4	“
“ alley s. of, crossing Wayne	4	“
“ alley n. of, from alley w. of Bates to St. Antoine	4	“
“ alley n. of, from alley e. of Griswold to First	4	“
“ alley n. of, from First to Third	8	“
Jerome ave., n. from Piquette 478 ft	3	“
“ from Milwaukee to s. line of N. Boulevard	4	“
“ s. from 24-in. main in N. Boulevard 87 ft	6	“
Joe st., from Michigan ave. to alley s. of Buchanan	6	“
John R. st., from e. line of Woodward to Miami	12	“
“ from Miami to Adams	4	“
“ from Adams to Columbia	6	“
“ from Columbia to Edmund	8	“
“ from Edmund to Erskine	6	“
“ crossing Eliot and Rowena	6	“
“ from Brady to Piquette	6	“
“ n. from Baltimore 250 ft	3	“
“ s. from Milwaukee 30 ft	6	“
“ crossing N. Boulevard	8	“
“ from alley s. of Custer to Hamlin	6	“
Johnson st., from Nineteenth to alley w. of Eighteenth	4	“
Jones st., from Cass to 160 ft. w. of Fifth	4	“
“ e. from Sixth 240 ft	3	“
Jos. Campau ave., from Atwater to Clinton	6	“
“ from Jay to s. line of Gratiot	6	“
“ from s. line of Gratiot to St. Joseph	4	“
“ from St. Joseph to 128 ft. n. of Forest	6	“
“ Theodore to 238 ft. n. of Arthur	6	“
“ crossing N. Boulevard	8	“
Josephine ave., from e. to w. line of Woodward	6	“
Joy st., from Cass to alley e. of Third	4	“
“ from Fourth to Fifth	4	“

LOCATION.	DIAM. INCHES.	KIND.
Junction ave., from River to Driggs	6	iron.
“ from s. line of Wabash R. R. to s. line of Fort	6	“
“ from s. line of Fort to 177 ft n. of Norton	8	“
Kanter ave., from 185 ft. w. of Collins to Moran	4	“
“ crossing Collins	6	“
“ w. from Mt. Elliott 181 ft	4	“
Kercheval ave,, from Mt. Elliott to Beaufait	4	“
“ from Field to Baldwin	4	“
King ave., from 16 in. main to e. line of Woodward	6	“
Kinsman st., from Scotten to Twenty-eighth	4	“
Kirby ave., from Woodward to w. line of Cass	4	“
“ w. from Fourth 180 ft	4	“
“ e. from Crawford 430 ft	3	“
“ from Crawford to w. line of Trumbull	4	“
“ from Commonwealth to National	4	“
“ from Harrison to 195 ft. w. of Twelfth	4	“
“ w. from Fourteenth 126 ft	4	“
“ from Sixteenth to Eighteenth	4	“
“ w. from Twenty-seventh 247 ft	4	“
“ crossing John R. and Grandy	4	“
“ e. from Russell 216 ft	4	“
“ e. from St. Aubin 300 ft	4	“
“ w. from Chene 440 ft	4	“
“ crossing Collins	6	“
“ e. from Helen 238 ft	4	“
Koch ave., from 16 in. main to e. line of Woodward	6	“
“ from e. line of Woodward to Oakland	4	“
Labrosse st., from Fourth to Fifth	4	“
“ w. from Tenth 430 ft	3	“
“ from 430 ft. w. of Tenth to Twelfth	4	“
“ alley s. of, from Fourth to alley e. of Twelfth	4	“
“ alley n. of, from alley e. of Fifth to Eighth	4	“
“ alley n. of, from Eighth to Tenth	3	“
Lady's lane, n. from Dry-Dock 214 ft	4	“
Lafayette ave., from Griswold to Shelby	4	“
“ w. from Tenth 743 ft	4	“
“ from 743 ft. w. of Tenth to M. C. R. R. bridge	3	“
“ from Twelfth to Fourteenth	4	“
“ from w. line of Fourteenth to Fifteenth	3	“
“ from Fifteenth to alley w. of Sixteenth	4	“
“ from Twenty-second to alley e. of	4	“
“ from Twenty-third to Twenty-fourth	4	“
“ e. from Scotten 256 ft	4	“
“ alley s. of, from Griswold to Shelby	6	“
“ alley s. of, from Wayne to First	6	“
“ alley s. of, from First to Fourth	4	“
“ alley s. of, from Fifth to Tenth	4	“
“ alley n. of, from Shelby to First	4	“
“ alley n. of, from First to Tenth	6	“
“ alley n. of, w. from Tenth 323 ft	4	“
“ alley n. of, e. from Fourteenth 190 ft	3	“
Lafayette pl., e. from Scotten 364 ft	4	“
Lafferty st., from River to Fort	4	“
“ from Fort to s. side M. C. R. R	6	“
Lambie pl., e. from Twenty-second 240 ft	2¼	wood.
“ crossing Twenty-second	4	iron.

LOCATION.	DIAM. INCHES.	KIND.
Langley ave., from Fourth to 562 ft. w. of Crawford	4	iron.
Lanman st., crossing Vinewood, e. side	4	“
Lansing ave., from Fort to 159 ft. n. of Christiancy	6	“
“ from Dix to Toledo	6	“
Larned st., from Third to Hastings	16	“
“ from Bates to Brush	4	“
“ from St. Antoine to Dequindre	4	“
“ from Riopelle to St. Aubin	12	“
“ from St. Aubin to Elmwood	4	“
“ crossing Leib, e. side	4	“
“ from Leib to Mt. Elliott	2¼	wood.
“ crossing Mt. Elliott, w. side	4	iron.
“ w. from Helen 156 ft	4	“
“ from Woodward to alley w. of	8	“
“ from Third to Fourth	8	“
“ from Fourth to Fifth	4	“
La Salle ave., n. from Michigan 505 ft	6	“
“ from n. line of Grand Trunk R. R. to 400 ft. n. of Nall	6	“
“ from 359 ft. s. to 398 ft. n. of Hancock	6	“
“ s. from McGraw 335 ft	6	“
Lauderdale ave, w. from Junction 196 ft	4	“
Laurel st., from Grand River to Wabash	4	“
Leavitt ave., from Wesson to Livernois	4	“
Ledyard st., from Cass to Third	6	“
Leib st., from Wight to Jefferson	6	“
“ from Jefferson to Champlain	4	“
“ from Champlain to Monroe	3	“
Leicester court, from 16-in main to e. line of Woodward	6	“
“ e. from Woodward 940 ft	4	“
Leland st., w. from Beaubien 206 ft	3	“
“ from Beaubien to 21 ft. e. of Dequindre	4	“
“ from 21 ft. e. of Dequindre to 101 ft. w. of Dubois	2¼	wood.
“ from 101 ft. w. of Dubois to Chene	3	iron.
“ crossing Chene	4	“
“ e. from Chene 160 ft	3	“
“ from 160 ft. e. of Chene to Grandy	2¼	wood.
“ crossing Grandy	3	iron.
“ from Grandy to Jos. Campau	2¼	wood.
“ crossing Jos. Campau and McDougall	4	iron.
“ from Jos. Campau to McDougall	2¼	wood.
“ from McDougall to Collins	3	iron.
“ from 216 ft. w. of Moran to Gratiot	4	“
Leroy pl., n. from Forest 251 ft	3	“
Lessing st., e. from McClellan 158 ft	4	“
Leverette st., from Seventh to Eighth	4	“
“ e. from Twelfth 307 ft	3 & 4	“
“ alley s. of, from Eighth to Tenth	4	“
Lewis st., from Cass to Fourth	4	“
Lincoln ave., from Grand River to alley n. of	4	“
“ crossing Brigham n. side 36 ft	8	“
“ from Brigham to 510 ft. n. of Holden	6	“
“ s. from 24-in. main in N. Boulevard 64 ft	6	“
“ alley w. of, from alley n. of Grand River to s. line of Brigham	4	“
“ alley w. of, crossing Brigham s. side 16 ft	6	“
Linden st., w. from Harrison 140 ft	4	“

LOCATION.	DIAM. INCHES.	KIND.
Linden st., e. from Twelfth 218 ft.	2¼	wood.
" from Twelfth to Wabash	2¼	"
" crossing Twelfth and Thirteenth	4	iron.
" from Wabash to 45 ft. e, of Fourteenth	3	"
" crossing Wabash and Sixteenth	4	"
" from Sixteenth to Eighteenth	2¼	wood.
" crossing Humboldt	4	iron.
" from alley w. of Humboldt to Maybury	4	"
" from Tillman to Twenty-fourth	4	"
" from Twenty-fifth to 26 ft. e. of Twenty-sixth	4	"
Livernois ave., from Dix to M. C. R. R	8	"
" from M. C. R. R. to n. line of city limits	10	"
Locust st., from Grand River to Fourth	6	"
" from Fourth to alley e. of Trumbull	4	"
" from alley w. of Trumbull to 30 ft. e. of National	3	"
" e. from National 30 ft.	4	"
" from Harrison to Wabash	4	"
Lorman ave., from Crane to Company	4	"
Louis ave., from Crane to w. line of Holcomb	4	"
Lovett ave., from Michigan to Buchanan	6	"
" from Rich to 264 ft. n. of Herbert	6	"
Ludden st., from Gratiot to Mt. Elliott	4	"
Lyman st., from Crystal to Orleans	4	"
Lysander st., from Fourth to Crawford	3	"
" crossing Sixth w. side	4	"
" from Sixth to Seventh	3	"
" from Seventh to Lincoln	4	"
" from National to 199 ft. w. of Twelfth	4	"
McArthur st., w. from Twenty-seventh 340 ft.	4	"
McClellan ave., from Jefferson to Marietta	6	"
" from Marietta to Mack	8	"
" from s. line of Mack to 144 ft. n. of Julia H	10	"
McDougall ave., from Atwater to Clinton	6	"
" from Gratiot to Canfield	4	"
" from Canfield to 154 ft. n. of Garfield	6	"
" from n. line of Palmer to Hendrie	6	"
" alley w. of, from Mullett to Jay	4	"
" alley w. of, from Cleveland to Hendricks	3	"
" alley w. of, from Hendricks to Hunt	4	"
" alley w. of, from Hunt to Charlevoix	3	"
" alley w. of, from Charlevoix to Arndt	3	wood.
" alley w. of, from Arndt to Berlin	4	iron.
" alley w. of, from Berlin to Heidelberg	2¼	wood.
" alley e. of, from Mullett to 88 ft. n. of Chestnut	4	iron.
" alley e. of, from Waterloo to Preston	3	"
McGraw ave., from Sixteenth to Sullivan	4	"
" from Grand River to Twenty-sixth	4	"
" from La Salle to Scotten	4	"
McKinstry ave., from River to n. line of Toledo	6	"
McMillan st., w. from Junction 272 ft.	4	"
" crossing Livernois e. side	4	"
Mack ave., from Gratiot to Cadillac	42	"
" from Gratiot to Townsend	4	"
" from Townsend to Baldwin	6	"
" crossing Mt. Elliott	6	"
" w. from w. line of Helen 80 ft.	6	"

LOCATION.	DIAM. INCHES.	KIND.
Mack ave., from Thorburn to Vandyke	8	iron.
" from 75 ft. w. of La Clede to 65 ft. e. of Crane	8	"
Macomb st., from St. Antoine to Elmwood	4	"
" alley s. of, from Brush to alley w. of	3	"
" alley s. of, from Brush to St. Antoine	4	"
" alley n. of, from Brush to alley w. of	3	"
" alley n. of, from Brush to St. Antoine	4	"
Madison ave., n. and s. sides, from Witherell to John R	4	"
" from Randolph to St. Antoine	4	"
" alley s. of, from John R. to Randolph	4	"
" alley n. of, from John R. to Randolph	4	"
Magnolia st., from Harrison to Thirteenth	4	"
" from Thirteenth to Wabash	3	"
" from Eighteenth to Sullivan	3	"
" from Sullivan to Maybury	4	"
" crossing Humboldt and Twenty-fourth	4	"
" from Twenty-seventh to Vinewood	4	"
Mansur st., from Harper to 78 ft. s. of Piquette	4	"
Maple st., from Gratiot to Orleans	8	"
" from Orleans to St. Aubin	4	"
" from St. Aubin to Dubois	6	"
" crossing Dubois	8	"
" from Dubois to Elmwood	6	"
Marcy st., w. from Fourth 158 ft	3	"
" from 158 ft. w. of Fourth to Crawford	4	"
Marietta st., e. from McClellan 521 ft	4	"
Mark st., w. from Twelfth 180 ft	4	"
Marston Court, from 16-in. main to e. line of Woodward	6	"
Martin pl., from Woodward to John R	4	"
Maybury ave., from Michigan to n. line of Ash	6	"
" from Ash to 34 ft. n. of G. T. Ry	8	"
" from 207 ft. s. of, to 173 ft. n. of Warren	8	"
" s. from Hudson 256 ft	8	"
Mechanic st., from Brush to Beaubien	4	"
Medbury ave., from Woodward to 350 ft. e. of John R	4	"
" w. from St. Aubin 730 ft	3	"
" crossing St. Aubin	4	"
" w. from Dubois 146 ft	4	"
" from Chene to Jos. Campau	4	"
" w. from Collins 165 ft	4	"
" crossing Collins	6	"
" from Helen to Frontenac	4	"
Meldrum ave., from Jefferson to Congress	42	"
" from Wight to 46 ft. n. of Fort	6	"
" from 46 ft. n. of Fort to 360 ft. n. of Kercheval	4	"
" from 360 ft. n. of, to 570 ft. n. of Kercheval	6	"
" from Arndt to Gratiot	6	"
Merrick ave., from Cass to Third	4	"
" w. from Fourth 136 ft	4	"
" from 136 ft. w. of Fourth to e. line of Crawford	3	"
" from e. line of Crawford to Lincoln	4	"
" from Trumbull to Twelfth	4	"
" w. from Twelfth 214 ft	3	"
" from 214 ft. w. of Twelfth to Wabash	3	wood.
" from Tillman to Twenty-third	4	iron.
" from Twenty-seventh to Vinewood	4	"

LOCATION.	DIAM. INCHES.	KIND.
Miami ave., from Gratiot to Witherell	16	iron.
" n. side, from John R. to Witherell	4	"
" alley w. of, from Gratiot to alley s. of	6	"
" alley w. of, from Gratiot to Witherell	4	"
" alley e. of, from Gratiot to John R	4	"
Michigan ave., from Woodward to Cass	24	"
" from Washington to First	10	"
" from First to Twenty-fourth	8	"
" from Twenty-fourth to Livernois	6	"
" alley s. of, from Shelby to Cass	4	"
" alley n. of, from alley e. of Griswold to alley e. of Washington	4	"
" alley n. of, from alley w. of Washington to alley w. of Cass	4	"
Military ave., from River to 250 ft. n. of Wabash R. R	6	"
" from 62 ft. n. of Anthon to 157 ft. n. of McMillan	6	"
Miller st., from Sixth to Seventh	3	"
" crossing Seventh	4	"
Milwaukee ave., from Beaubien to Green	6	"
" from Eighteenth to 36 ft. w. of Sullivan	4	"
" from Beaubien to w. line of Riopelle	4	"
" from Dubois to Jos. Campau	4	"
" crossing Collins	8	"
Minnie ave., from River to 642 ft. s. of Fort	6	"
" s. from Fort 642 ft	4	"
Mitchell ave, n. from Gratiot 265 ft	6	"
" from 265 ft. n. of Gratiot to Canfield	4	"
" from Canfield to Ferry	6	"
" from 24 ft. n. of Palmer to Harper	6	"
" n. from Harper 324 ft.	4	"
" from Trombly to Griffin	4	"
Moeller st., e. from Russell 389 ft	4	"
Mohawk st., crossing Vinewood	4	"
Monroe ave., n. from Cadillac Square 51 ft	6	"
" from 51 ft. n. of Cadillac Square to Farmer	4	"
" from St. Antoine to Elmwood	4	"
" w. from Leib, 216 ft	4	"
" w. from Helen 185 ft	4	"
" from Crane to alley w. of	4	"
" alley s. of, from alley n. of Cadillac Square to Randolph	4	"
" alley n. of, from alley e. of Woodward to Farmer	4	"
" alley n. of, from Farmer to alley e. of Farrar	6	"
Montcalm st., w. from Woodward 412 ft	4	"
" from 412 ft. w. of Woodward to Cass	3	"
" from alley e. of Woodward to Brush	4	"
" from Brush to St. Antoine	3	"
" St. Antoine to Hastings	6	"
" from Hastings to Russell	3	"
" alley s. of, w. from Beaubien 240 feet	2¼	wood.
Monteith st., crossing Vinewood, e. side	4	iron.
" w. from Twenty-seventh 116 ft	4	"
Moran st., from Gratiot to Dane	6	"
Morrell st., from River to s. line of Christiancy	6	"
" from 348 ft. s. of Dix to Toledo	6	"
Mott st., from 16-in. main to e. line of Woodward	6	"
" e. from Woodward 558 ft	4	"
Mt. Elliott ave., from 148 ft. s. of Wight to 1,125 ft s. of Waterloo	6	"
" from 1,125 ft. s. of Waterloo to Preston	8	"

LOCATION.	DIAM. INCHES.	KIND.
Mt. Elliott ave., from Preston to Mack	10	iron.
“ from Mack to Gratiot	8	“
“ from Gratiot to 300 ft. n. of Griffin	4	“
Mullett st., from Gratiot to Chene	30	“
“ from St. Antoine to Elmwood	4	“
“ w. from Crane 211 ft	4	“
Mulberry st., from Twelfth to Thirteenth	4	“
Myrtle st., from Grand River to Hubbard	6	“
Nall ave., crossing Vinewood	6	“
Napoleon st., from Brush to Russell	4	“
National ave., from 130 ft. s. of Lysander to 125 ft. n. of Putnam	6	“
Newark st., from Nineteenth to Twentieth	6	“
“ e. from Foundry in Griffin's foundry	8	“
Nineteenth st., from Fort to Baker	4	“
“ from Baker to Newark	6	“
Noble st., w. from Fourth 150 ft	3	“
“ from 150 ft. w. of Fourth to Crawford	4	“
“ from Sixth to Seventh	4	“
Norton st., e. from Junction 386 ft	4	“
“ e. from Wesson 283 ft	4	“
Oakland ave., from 24 in. main to n. line of N. Boulevard	10	“
“ from Horton to Hamlin	6	“
“ crossing Harmon	10	“
Orchard st., from First to e. side of Elton Park	4	“
“ from w. side of Elton Park to Sixth	4	“
“ from Sixth to Trumbull	6	“
Orleans st., from Atwater to Jefferson	10	“
“ from Jefferson to Reservoir grounds	8	“
“ from Congress to Reservoir basin	24	“
“ from Reservoir to Scott	30	“
“ s. from Canfield 30 ft	30	“
“ crossing Leland s. side	6	“
“ from Alexandrine to Canfield	6	“
“ n. from Garfield 252 ft	4	“
“ from 252 ft. n. of Garfield to 195 ft. n. of Forest	6	“
“ from Trombly to Lyman	4	“
Ottawa st., e from Thirteenth 130 ft	8	“
Owen ave., from 16 in. main to 1220 ft. e. of Woodward	6	“
Pallister ave., crossing Woodward	4	“
“ from Woodward to Russell	3	wood.
“ from Russell to 393 ft. e. of St. Aubin	6	iron.
“ on n. line connecting 16-in. to 8-in. main in Woodward	8	“
Palmer ave., from Woodward to w. line of Brush farm	4	“
“ crossing Russell and St. Aubin	4	“
“ from 126 ft. w. of Dubois to e. line of Grandy	4	“
“ crossing Collins	6	“
“ w. from Vandyke 231 ft	4	“
Park pl., from Michigan to State	4	“
Park st., from Woodward to alley s. of Columbia	6	“
“ from e. line of Woodward to Washington	16	“
“ from Henry to Peterboro	4	“
Parsons st., from Woodward to Cass	4	“
Perry st., from Sixth to alley e. of Trumbull	4	“
“ from alley w. of Trumbull to National	4	“
“ alley s. of, from alley e. of Seventh to alley e. of Trumbull	4	“
Peterboro st., from Woodward to Cass	4	“
Pierce st., from Dequindre to Jos. Campau	4	“
Pine st., from Grand River to National	4	“

LOCATION.	DIAM. INCHES.	KIND.
Pine st., from National to Twelfth	3	iron.
“ crossing Twelfth e. side	4	“
Pitcher st., from Cass to alley e. of Third	4	“
“ w. from Fourth 150 ft	3	“
“ from 150 ft. w. of Fourth to Crawford	4	“
“ from Sixth to Seventh	4	“
Pingree ave., from Woodward to Crawford	6	“
Piquette ave., from Woodward to Beaubien	4	“
“ from Beaubien to Hastings	3	“
“ from Hastings to Russell	4	“
“ w. from Chene 466 ft	4	“
“ crossing Collins	6	“
“ e. from Moran 85 ft	4	“
“ w. from Mt. Elliott 326 ft	4	“
“ from Wabash to Fourteenth	4	“
“ from Eighteenth to Sullivan	4	“
Pleasant ave , n. from River 515 ft	4	“
Plum st., from Second to alley e. of Trumbull	4	“
“ from Trumbull to alley e. of	6	“
Plumer st., from 523 ft. e. of, to 185 ft. w. of Junction	4	“
“ from Welch to Livernois	4	“
Poplar st., from 110 ft. e. of Wabash to Fourteenth	4	“
“ crossing Thirteenth and Fifteenth	4	“
“ from Tillman to 209 ft. w. of Twenty-third	4	“
“ e. from Welch 82 ft	4	“
Porter st., w. from Twelfth 210 ft	3	“
“ from 210 ft. w. of Twelfth to Thirteenth	4	“
“ crossing Fourteenth	4	“
“ e. from Fourteenth 172 ft	3	“
“ from Eighteenth to alley w. of	4	“
“ from alley w. of Eighteenth to Nineteenth	3	wood.
“ from Twentieth to Twenty-first	3	iron.
“ w. from Twenty-first 175 ft	2¼	wood.
“ from 175 ft. w. of Twenty-first to Twenty-second	3	iron.
“ from Twenty-second to Twenty-third	4	“
“ from Twenty-third to Twenty-fourth	2¼	wood.
“ from Twenty-fourth to e. line of W. Boulevard	4	iron.
“ from e. line of W. Boulevard to Vinewood	6	“
“ from Hubbard to Scotten	3	“
“ from McKinstry to Ferdinand	4	“
“ alley s. of, from Thirteenth to alley e. of	3	“
Prentiss ave., from Cass to Third	4	“
Preston st., from Gratiot to w. line of Elmwood	3	wood.
“ from w. line of Elmwood to Mt. Elliott	4	iron.
Private st., n. of Ferry, crossing Rivard	4	“
“ n. of Ferry, w. from Rivard 362 ft	3	“
Private way, e. of Russell, s. from Pallister 405 ft	4	“
Pulford ave., e. from Gratiot 315 ft	4	“
“ w. from Mt. Elliott 161 ft	4	“
“ from Meldrum to Beaufait	4	“
Putnam ave., w. from Woodward 60 ft	6	“
“ from 60 ft. w. of Woodward to w. line of Cass	4	“
“ from Fourth to Lincoln	4	“
“ from Trumbull to Twelfth	4	“
“ w. from Twelfth 185 ft	3	“
Randolph st., from alley s. of Atwater to Jefferson	4	“
“ from Atwater to 24 in. main in Cadillac square	8	“
“ from Larned to Congress	4	“

LOCATION.	DIAM. INCHES.	KIND.
Randolph st., from Congress to Adams	6	iron.
" crossing Gratiot	10	"
" alley w. of, n. from Atwater	8	"
" alley e. of, from alley s. of Fort to Champlain	4	"
" alley e. of, from alley n. of Monroe to Gratiot	4	"
Ranspach st., from Hammond to Livernois	4	"
Raynor st., from Clinton to Gratiot	4	"
Reed pl., w. from Fourth 86 ft	4	"
" from 86 ft. w. of Fourth to Crawford	3	"
" w. from Crawford 185 ft	4	"
Reeder ave., from Junction to 438 ft. w. of Campbell	4	"
Reservoir grounds, n. of basin to 30 in. branch	24	"
" s. and w. sides of basin	24	"
Rich st., e. from Vinewood 204 ft	4	"
" from Scotten to Twenty-eighth	4	"
Riopelle st., from Atwater to Jefferson	8	"
" from Jefferson to Larned	12	"
" from Larned to Adelaide	8	"
" from Adelaide to 218 ft. n. of Hancock	6	"
" alley e. of, s. from Canfield 218 ft	4	"
Rivard st., from Atwater to Jefferson	8	"
" from Larned to Congress	4	"
" from Jefferson to Clinton	10	"
" from Mullett to Gratiot	10	"
" from Gratiot to Watson	4	"
" from Eliot to Warren	4	"
" from Warren to Farnsworth	8	wood.
" from Farnsworth to 221 ft. n. of Palmer	4	iron.
" from 221 ft. to 281 ft. n. of Palmer	6	"
" crossing Piquette	4	"
" from alley n. of Boulevard to Pallister	4	"
" n. from Pallister 1,178 ft	6	"
River st., from Third to Fourth	4	"
" from Fifth to Sixth	4	"
" from Sixth to e. side M. C. R. R.	8	"
" crossing M. C. R. R. tracks 270 ft	6	"
" from w. line of M. C. R. R. to 525 ft. w. of Twenty-fourth	8	"
" from Pleasant to Campau	8	"
" from Campau to main entrance of Exposition Grounds	6	"
" s. from main into Det. & L. S. Copper Works	4	"
Roby st., n. from Ferry 325 ft	4	"
Rohns ave., from Elm Grove to alley s. of Mack	6	"
Romeyn st., w. from Junction 274 ft	4	"
Rose st., from Eighteenth to Twentieth	4	"
Rosedale ave., from 16-in. main to e. line of Woodward	6	"
" from e. line of Woodward to w. line of Oakland	4	"
Rowena st., from Woodward to Riopelle	4	"
Rowland st., s. from State 187 ft	4	"
" n. from State 237 ft	6	"
Russell st., from Larned to Congress	6	"
" from Congress to Monroe	4	"
" from Mullett to Maple	8	"
" from Maple to Gratiot	4	"
" from Gratiot to Watson	8	"
" from Watson to Canfield	6	"
" from Canfield to s. line of Hendrie	10	"
" from s. line of Hendrie to s. line of Piquette	8	"
" from s. line of Piquette to Moeller	6	"

LOCATION.	DIAM. INCHES.	KIND.
Russell st., alley e. of, from Chase to Fort	2¼	wood.
" alley e. of, n. from Willis 220 ft	4	iron.
Sargent st., crossing Collins	6	"
Savoy st., from Twenty-first to Twenty-second	4	"
" from Twenty-third to Twenty-fourth	4	"
Schiller st., e. from McClellan 245 ft	4	"
Schulte ave., from alley n. of Boulevard to Pallister	4	"
Scott st., from Orleans to Chene	30	"
" from Riopelle to e. line of St. Aubin	4	"
" from e. of St. Aubin to Dubois	3	"
" crossing Dubois and Chene	4	"
" e. from Dubois 190 ft	3	wood.
" from 190 ft. e. of Dubois to 499 ft. e of Chene	3	iron.
" from 499 ft. e. of Chene to Jos. Campau	4	"
Scotten ave., from Fort to Dix	6	"
" from Dix to Buchanan	8	"
" from Buchanan to McGraw	6	"
Sears ave., from Holcomb to McClellan	4	"
Second st., from Front to alley n. of Jefferson	6	"
" from Jefferson to alley n. of	10	"
" crossing Congress	10	"
" from Abbott to alley s. of	8	"
Second st. and ave., from Abbott to Bagg	10	"
" ave., from High to 166 ft. n. of Henry	4	"
" from Bagg to 30 ft. n. of Prentiss	6	"
" crossing Canfield	8	"
" e. side from s. line of Forest to 184 ft. n. of	6	"
" e. side, crossing Hancock, Warren and Putnam	6	"
" e. side, crossing Merrick, Kirby and Holden	6	"
" w. side, crossing Hancock, Warren and Putnam	4	"
" w. side, crossing Merrick, Kirby and Holden	4	"
" s. from Holden 700 ft	3	wood.
" from Holden to 205 ft. n. of Milwaukee	6	iron.
" crossing N. Boulevard	8	"
" alley e. of, from alley n. of Canfield to Prentiss	4	"
Selden ave., from Woodward to Third	4	"
" from Fourth to alley w. of	4	"
" from alley w. of Fourth to Crawford	3	"
" from Sixth to Seventh	4	"
Seventh st., from River to alley n. of Lafayette	8	"
" from alley n. of Lafayette to Bagg	10	"
" from Bagg to Grand River	8	"
" from Grand River to Brigham	6	"
" crossing Brigham	8	"
" from Brigham to 150 ft. n. of Lysander	2¼	wood.
" from 150 ft. n. of Lysander to n. line of Putnam	6	iron.
" crossing Merrick	6	"
" from 214 ft. s. of Kirby to 339 ft. n. of Stanley	6	"
" alley w. of, from alley n. of Pine to Spruce	3	"
" alley w. of, from Perry to alley s. of	4	"
Seventeenth st., from Fort to 28 ft. s. of Poplar	6	"
" from 28 ft. s. of Poplar to Buchanan	4	"
" from Buchanan to 244 ft. n. of Hancock	6	"
" from 42 ft. n. of Merrick to Kirby	6	"
" s. from 24-in. main in N. Boulevard 62 ft	6	"
Shady lane, crossing W. Boulevard	4	"
" crossing Vinewood	6	"
Shelby st., w. side, Atwater to Woodbridge	3	"

LOCATION.	DIAM. INCHES.	KIND.
Shelby st., w. side, Woodbridge to Jefferson	4	iron.
" e. side, Woodbridge to Jefferson	8	"
" from Jefferson to Michigan	10	"
" from Lafayette to alley s. of Michigan	4	"
Sheridan ave., from Jefferson to Kercheval	6	"
Sherman st., from Hastings to Elmwood	4	"
" from Crane to alley w. of	4	"
Sibley st., from Woodward to Clifford	4	"
Sidney ave., from 16 in. main in Woodward to w. line of Oakland	6	"
Sixth st., from River to Congress	16	"
" from Congress to Abbott	24	"
" from River to alley n. of	4	"
" from alley n. of Labrosse to Bagg	4	"
" n. from Bagg 88 ft	8	"
" from 88 ft. n. of Bagg to 478 ft. n. of Grand River	4	"
" from 478 ft. n. of Grand River to Brigham	6	"
" crossing Brigham	6 and 8	"
" from Brigham to 265 ft. n. of Lysander	4	"
Sixteenth st., from Lafayette to Myrtle	6	"
" from Myrtle to Buchanan	8	"
" from Buchanan to Grand River	10	"
" from Grand River to McGraw	6	"
" s. from 24 in. main in N. Boulevard 63 ft	8	"
" alley w. of, from Lafayette to Howard	3	"
Smith ave., from Woodward to Oakland	4	"
South st., from Grand River to Noble	4	"
Southern ave., e from Livernois 152 ft	4	"
Spencer st., from Cass to Second	4	"
Sproat st., from Woodward to Cass	4	"
Spruce st., from Fifth to alley w. of Seventh	4	"
" from alley w. of Trumbull to National	4	"
" from Harrison to Twelfth	4	"
" alley s. of, from alley w. of Seventh to alley e. of Trumbull	3	"
St. Albertus pl., from 22 ft. e. of Dequindre to 260 ft. w. of St. Aubin.	4	"
" w. from St. Aubin 260 ft	3	"
St. Antoine st., from Atwater to Congress	8	"
" from Jefferson to Congress	4	"
" from Congress to Gratiot	6	"
" crossing Champlain	8	"
" from Gratiot to Elizabeth	4	"
" from Elizabeth to Adelaide	6	"
" from Adelaide to Watson	8	"
" from Watson to Farnsworth	6	"
" crossing Frederick	6	"
" n. from Piquette 445 ft	6	"
" from 150 ft. s. of Milwaukee to 4 in. in N. Boulevard	6	"
" crossing N. Boulevard	8	"
St. Aubin ave., from Atwater to Harper	6	"
" crossing Trombly	6	"
" from Pallister to 75 ft. n. of Vulcan	6	"
" from Congress to Champlain	36	"
" from Larned to Congress	12	"
" crossing N. Boulevard	10	"
" alley w. of, s. from Ferry 266 ft	2¼	wood.
St. Clair pl., from Nineteenth to alley w. of Eighteenth	4	iron.
St. Joseph st., from Russell to Riopelle	3	"
" from e. line of Riopelle to 310 ft. e. of St. Aubin	4	"
" from 310 ft. e. of St. Aubin to 202 ft. e. of Chene	3	"

LOCATION.	DIAM. INCHES.	KIND.
St. Joseph st., from 202 ft. e. of Chene to Grandy	4	iron.
“ from Grandy to Joseph Campau	2¼	wood.
“ from w. line of McDougall to 438 ft. e. of	3 & 4	iron.
St. Paul ave., from Bellevue to e. line of Concord	4	“
“ from w. line of E. Boulevard to e. line of Field	4	“
“ from Townsend to Baldwin	4	“
“ from Crane to alley w. of	4	“
Standish st., from Twentieth to Foundry	6	“
Stanley ave., from Seventh to w. line of Trumbull	4	“
“ w. from Twelfth 183 ft	4	“
Stark ave., from Welch to Livernois	4	“
State st., from Woodward to Washington	30	“
“ from Woodward to Washington,	10	“
“ w. of branch in Washington 24 ft	24	“
Stimson pl., from Woodward to Cass	4	“
Sullivan ave., from Michigan to 270 ft. n. of Linden	6	“
“ s. from Buchanan 288 ft	6	“
“ n. from McGraw 61 ft	6	“
“ from 104 ft. s. of Piquette to 250 ft. n. of Wreford	6	“
“ from s. to n. line of N. Boulevard	8	“
Summit ave., from River to Wabash R. R	6	“
Superior st., w. from Beaubien 220 ft	4	“
“ from Beaubien to Hastings	2¼	wood.
“ crossing St. Antoine and Hastings	4	iron.
“ e. from Hastings 359 ft	3	wood.
“ crossing Russell and Riopelle	4	iron.
“ w. from Rivard 437 ft	4	“
“ from Rivard to Russell	2¼	wood.
“ from Riopelle to Dequindre	4	iron.
“ from Dequindre to St. Aubin	2¼	wood.
“ crossing St. Aubin and Chene	4	iron.
“ from St. Aubin to 343 ft. e. of Chene	3	“
“ from 197 ft. w. of Grandy to Mitchell	4	“
“ from McDougall to Gratiot	4	“
Swain ave., from 40 ft. s. of Wabash R. R. to Fort	6	“
Sycamore st., w. from Grand River 123 ft	6	“
“ from alley w. of Trumbull to National	4	“
“ from Harrison to Wabash	4	“
Sylvester st., from Gratiot to Mt. Elliott	4	“
“ from Beaufait to Bellevue	4	“
Tenth st., from River to Baker	8	“
“ from Baker to Michigan	6	“
Theodore st., e. from John R. 402 ft	4	“
“ from 226 ft. w. of Beaubien to 106 ft. e. of Riopelle	4	“
“ from 268 ft. w. of St. Aubin to Grandy	4	“
“ crossing Collins.	6	“
“ from Mt. Elliott to w. line of Beaufait	4	“
Third st., from Front to s. line of River	6	“
“ from s. line of River to Larned	8	“
“ from Larned to alley n. of	6	“
“ from Larned to Fort	24	“
“ from alley s. of Porter to Michigan	3	“
“ from Michigan to Grand River	4	“
Third ave., from Grand River to Bagg	8	“
“ from Bagg to Holden	6	“
“ crossing Brigham	8	“
“ from Brigham to Canfield	30	“
“ alley e. of, from Henry to Brainard	4	“

LOCATION.	DIAM. INCHES.	KIND.
Thirteenth st., from Porter to 112 ft. n. of Elm	6	iron.
" crossing Myrtle	6	"
" from Magnolia to Grand River	6	"
" n. from Grand River 499 ft	4	"
" s. from Hancock 80 ft	6	"
" n. from Hancock 150 ft	4	"
" from 150 ft. n. of Hancock to n. line of Warren	6	"
" alley e. of, s. from Porter 121 ft	4	"
Thirty-first st., from Michigan to 286 ft. s. of Warren	6	"
Thirty-second st., from Michigan to 87 ft. n. of Buchanan	6	"
Thirty-third st., from Michigan to 462 ft. n. of Buchanan	6	"
Thorburn ave., s. from Mack 624 ft	6	"
Tillman ave., from Michigan to Breckenridge	6	"
" s. from Warren 198 ft	6	"
" s. from Merrick (on the w.) 360 ft	6	"
Toledo ave., from 360 ft. e. of Scotten to McKinstry	4	"
" from McKinstry to Junction	6	"
" from 17 ft. e. of Campbell to Livernois	6	"
Townsend ave., from Jefferson to Kercheval	6	"
" n. from Mack 208 ft	6	"
" from 208 ft. n. of Mack to s. line of Gratiot	4	"
" from s. line to 8-in. main in Gratiot	8	"
Trombly ave., from Crystal to 7 ft. e. of St. Aubin	4	"
" from Chene to Ellery	4	"
" crossing Collins	6	"
Trowbridge ave., from 16-in. main to e. line of Woodward	6	"
" e. from Woodward 511 ft	4	"
Trumbull ave., from Abbott to alley s. of	10	"
" n. from Abbott 30 ft	6	"
" from Michigan to Plum	6	"
" from Grand River to alley n. of	6	"
" from Brigham to Forest	8	"
" from Forest to 497 ft. n. of G. T. Ry	6	"
" from 50 ft. n. of Piquette to Holden	6	"
" alley e. of, from Plum to Sycamore	6	"
" alley w. of, from Cherry to Pine	3	"
" alley w. of, from Pine to Myrtle	4	"
" alley w. of, from alley n. of Grand River to Brigham	6	"
Tuscola st., alley s. of, from alley w. of Fourth to Crawford	4	"
" alley n. of, from alley w. of Fourth to Crawford	4	"
Twelfth st., from 458 ft. s. of River to Lafayette	4	"
" from Howard to Baker	4	"
" from Baker to Brigham	6	"
" from Brigham to s. line of N. Boulevard	8	"
" from s. line of N. Boulevard to 24 in. main	10	"
Twentieth st., from Fort to Michigan	6	"
" alley e. of, s. from Rose 197 ft	3	"
Twenty-first st., from Fort to Standish	4	"
Twenty-second st., from Fort to Dalzelle	6	"
Twenty-third st., from Fort to 330 ft. n. of Porter	4	"
" from 330 ft. n. of Porter to 419 ft. n. of Dalzelle	3	"
" crossing Baker	4	"
" n. from M. C. R. R. 259 ft	3	"
" from 259 ft. n. of M. C. R. R. to Magnolia	6	"
" from Magnolia to 35 ft. n. of Linden	3	"
" from 35 ft. n. of Linden to L. S. R. R	4	"
" from Buchanan to 150 ft. n. of Hancock	6	"
" s. from Warren 295 ft	6	"

LOCATION.	DIAM. INCHES.	KIND.
Twenty-third st., from Merrick to Kirby	6	iron.
“ from Kirby to McGraw	4	“
Twenty-fourth st., from River to Fort	4	“
“ from Fort to Baker	6	“
“ from Baker to 20 ft. n. of Michigan	8	“
“ from 20 ft. n. of, to 54 ft. n. of Michigan	12	“
“ from 54 ft. n. of, to 96 ft. n. of Michigan	16	“
“ from 96 ft. n. of, to 181 ft. n. of Michigan	18	“
“ from 181 ft. n. of, to 236 ft. n. of Michigan	20	“
“ from 236 ft. n. of Michigan to Butternut	24	“
“ from Butternut to Buchanan	10	“
“ from Buchanan to McGraw	8	“
Twenty-fifth st., from Howard to Baker	4	“
“ from Baker to 100 ft. s. of Toledo	6	“
“ from E st. to Michigan	4	“
“ from Michigan to Linden	6	“
“ n. from Linden 192 ft	3	“
“ from 595 ft. s. of, to 165 ft. n. of Buchanan	6	“
“ s. from Hancock 399 ft	6	“
Twenty-sixth st., from 50 ft. s. of E st. to Buchanan	6	“
“ from 410 ft. s. of Kirby to McGraw	6	“
Twenty-seventh st., from Dix to 327 ft. s. of Toledo	6	“
“ from Michigan to Monteith	6	“
“ from Merrick to Hudson	6	“
Twenty-eighth st., from Michigan to 127 ft. n. of Kinsman	6	“
Twenty-ninth st., from 565 ft. s. of Michigan to Buchanan	6	“
Union st., from Fourth to Fifth	3	“
Uthes ave., from Clark to McKinstry	4	“
Van Dyke ave., from Jefferson to 150 ft. n. of Waterloo	8	“
“ from Mack to Gratiot	8	“
“ from Gratiot to s. line of Centre-line road	6	“
Vine st., from Fourth to Fifth	3	“
Vinewood ave., from Fort to Buchanan	24	“
“ from Fort to 430 ft. n. of Toledo	6	“
“ from F to Buchanan	6	“
“ from Buchanan to Merrick	10	“
“ s. from Grand River 300 ft	8	“
Visgar st., from Vinewood to La Salle	6	“
Volunteer ave., w. from Junction 315 ft	4	“
Wabash ave., from n. line of M. C. R. R. to Ottawa	6	“
“ from Ottawa to Grand River	4	“
“ from Grand River to s. line of L. S. R. R	2¼	wood.
“ from s. line of L. S. R. R. to 186 ft. n. of Piquette	6	iron.
“ crossing Warren	6	“
“ s. from 24-in. main in N. Boulevard 63 ft	6	“
“ alley e. of, from 135 ft, s. of Butternut to Myrtle	2¼	wood.
“ alley east of, crossing Myrtle	4	iron.
Walker st., from Atwater to Jefferson	4	“
Warren ave., from w. line of Cass to 105 ft. e. of Riopelle	4	“
“ from St. Aubin to 117 ft. w. of Chene	4	“
“ from 158 ft. w. of, to e. line of Grandy	4	“
“ crossing Collins	6	“
“ from Second to Third	4	“
“ from Fourth to Crawford	2¼	wood.
“ from Crawford to 106 ft. w. of Seventh	4	iron.
“ from National to alley w. of Wabash	4	“
“ from Fourteenth to Sixteenth	4	“
“ from w. line of Sullivan to w. line of Twenty-fourth	6	“

LOCATION.	DIAM. INCHES.	KIND.
Warren ave., from 169 ft. e. of, to w. line of Vinewood	6	iron.
Washington ave., from Michigan to State	30	"
" from Michigan to Park	10	"
" alley e. of, from alley n. of Michigan to alley s. of Park	4	"
" alley w. of, from alley n. of Michigan to alley s. of Park,	4	"
Waterloo st., from Dequindre to Jos. Campau	4	"
" from alley e. of McDougall to Elmwood	4	"
" e. from Elmwood 563 ft.	3	"
" from 563 ft. e. of Elmwood to w. line of Burlage pl	4	"
" from Mt. Elliott to 57 ft. e. of Beaufait	4	"
Watson st., from Woodward to Brush	4	"
" from Brush to Reservoir	24	"
" from Dequindre to Chene	2¼	wood.
" crossing St. Aubin, Dubois and Chene	4	iron.
Wayne st., s. from Woodbridge 173 ft	4	"
" from Woodbridge to Michigan	6	"
Webster pl., e. from Nineteenth 276 ft.	4	"
" e. from Twenty-second 240 ft.	2¼	wood.
Welch ave., from Plumer to s. line of M. C. R. R	6	iron.
" from 211 ft. s. of, to 225 ft. n. of Stark	6	"
" from Ingersoll to n. line of city limits	6	"
Wesson ave., from Toledo to L. S. R. R	6	"
" from n. line of G. T. Ry. to Leavitt	6	"
" from Det. L. and N. R. R. to 190 ft. n. of Herbert	6	"
Westminster ave., from 16-in. main to 320 ft. e. of Woodward	6	"
Whitaker ave., e. from Russell 731 ft.	4	"
Widman pl., n. from Harper 160 ft.	6	"
Wight st., from Chene to Leib	4	"
" from Leib to 110 ft. e. of Meldrum	6	"
" alley s. of, e. from McDougall 230 ft.	4	"
Wilcox st., from Woodward to Miami	12	"
Wilkins ave., from 16-in. main to w. line of Woodward	6	"
" from w. line of Woodward to e. line of Auburndale	4	"
Wilkins st., from Brush to Russell	4	"
" from 158 ft. w. of Riopelle to Dequindre	4	"
" e. from Dequindre 540 ft.	2¼	wood.
" from 540 ft. e. of Dequindre to e. line of St. Aubin	4	iron.
" from St. Aubin to 225 ft. e. of Dubois	3	wood.
" crossing Dubois and Chene	4	iron.
" w. from Chene 375 ft	2¼	wood
Williams ave., from Michigan to 196 ft. n. of Breckenridge	6	iron.
" from n. line of Merrick to Hudson	6	"
Williams rd., from 16-in. main to w. line of Woodward	6	"
Willis ave., from Woodward to Beaubien	4	"
" from Beaubien to St. Antoine	3	"
" from St. Antoine to Hastings	2¼	wood.
" e. from Hastings 356 ft.	4	iron.
" from 356 ft. e. of Hastings to Rivard	3	"
" from Rivard to Russell	3	wood.
" from w. line of Russell to Dequindre	4	iron.
" from e. line of Dequindre to 80 ft. e. of Dubois	2¼	wood.
" crossing St. Aubin and Chene	4	iron.
" from 80 ft. e. of Dubois to Grandy	3	"
" from Jos. Campau to McDougall	2¼	wood.
" crossing Mitchell	4	iron.
" from w. line of, to 291 ft. e. of McDougall	4	"
" e. from Collins 146 ft	4	"
" from Woodward to Third	6	"

LOCATION.	DI INC
Willis ave., from Fourth to Crawford	
" from Sixth to Eighth	
" e. from Twelfth 215 ft	
" crossing Twelfth	
Winder st., from Woodward to Orleans	
Wing pl., from Nineteenth to alley w. of Eighteenth	
Winslow ave., n. from Grand River 85 ft	
Winter st., e. from Dequindre 431 ft	
Witherell st., from e. line of Woodward to Miami	1
" from Woodward to Miami	
" from Miami to Adams	
" from Adams to alley n. of	
Wolff st., e. from Scotten 357 ft.	
Woodbridge st., from Randolph to Brush	
" e. from St. Antoine 230 ft.	
" from St. Antoine to Rivard	
" from Rivard to Russell	
" from Russell to Orleans	
" from Orleans to Dubois	
" w. from Jos. Campau 300 ft	
" e. from Jos. Campau 400 ft	4
" crossing Leib w. side 24 ft	4
" w. from Leib 300 ft	
" alley s. of, from Bates to Randolph	4
" alley s. of, from Brush to 210 ft. e. of Beaubien	
" crossing Woodward	
" from Woodward to Griswold	6
" from Griswold to First	4
" from First to Second	6
Woodland ave., from 16 in. main to e. line of Woodward	6
" e. from Woodward 780 ft	4
Woodward ave., from Atwater to Jefferson	1
" e. side, s. from Atwater 246 ft	
" w. side, s. from Atwater 171 ft	4
" from Jefferson to Soldiers' Monument	2
" from Atwater to Adams	
" from Adams to Baltimore	1
" from Baltimore to Pallister	
" from N. Boulevard to Woodland	1
" from High to 200 ft. n. of Canfield	4
" from Bagg to Edmund pl	2
" alley e. of, from alley s. of Atwater to alley s. of Jefferson	4
" alley e. of, from alley n. of Jefferson to alley n. of Congress	4
" alley e. of, from Gratiot to alley s. of	6
" alley e. of, from Gratiot to alley s. of Witherell	4
" alley e. of, from Elizabeth to alley s. of	8
" alley e. of, crossing Elizabeth	4
" alley e. of, from Columbia to Montcalm	4
" alley w. of, from Atwater to alley s. of Jefferson	4
" alley w. of, from n. of Jefferson to Larned	4
" alley w. of, from Larned to Congress	8
" alley w. of, from Congress to alley n. of	4
" alley w. of, from alley n. of Michigan to alley s. of Park	4
" alley w. of, from Montcalm to High	4
Woodward ave. terrace, from Woodward to John R	4
Wreford ave., from Grand River to 93 ft. e. of Sullivan	4
Zender pl., w. from Mt. Elliott 354 ft	4

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FORTY-FOURTH ANNUAL REPORT OF THE BOARD OF WATER COMMISSIONERS

NEW WATER WORKS.

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR

1895.

Calvert Lith.Co.Detroit

FORTY-FOURTH ANNUAL REPORT

OF THE

Board of Water Commissioners

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1895.

DETROIT·
THE DETROIT FREE PRESS PRINTING COMPANY.
1896.

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BOARD OF WATER COMMISSIONERS.

DETROIT, 1895-96.

MEMBERS:

FRANK E. KIRBY, 1896. ALBERT L. STEPHENS, 1897.
DEWITT H. MORELAND, 1898. EDWARD W. PENDLETON, 1899.
DARIUS D. THORP, 1900.

COMMITTEES:

Ways and Means	Commissioners PENDLETON, STEPHENS.
Extension and Construction	Commissioners MORELAND, PENDLETON.
Pumping Works	Commissioners STEPHENS, THORP.
Supplies	Commissioners THORP, MORELAND.

OFFICERS:

President	FRANK E. KIRBY.
Vice-President	ALBERT L. STEPHENS.
General Superintendent Secretary	L. N. CASE.
Civil Engineer	G. S. WILLIAMS.
Supt. of Extension	HENRY BRIDGE.
Supt. of Meters and Inspection	THOMAS R. PUTNAM.
Supt. of Grounds	E. A. SCRIBNER.
Chief Engineer at Pumping Works	URIAH GOULD.
Consulting Engineer " "	JOHN E. EDWARDS.
Meter Clerk	HARRY S. STARKEY.
Assessors and Collectors	FRED. H. HUTAFF. W. W. WILCOX. JOHN J. ROBINSON. PETER J. BECKER. THOS. W. GOODALE. ANTHONY VOGEL. CHARLES J. PATERSON. GEORGE A. WINSLOW.
Receiving Clerk	GEORGE E. KUNZE.
Permit Clerk	JOHN E. LONG.
Purchasing Agent	THOMAS E. LYNCH.
Auditor	J. A. M. MORETON.

DETROIT WATER WORKS.

METER RATES.

First 3,000 Cubic Feet, each month, each 100 gallons	⅜ of a cent.
All over, each 100 gallons	⅛ of a cent.

ASSESSMENT RATES.

From July 1st, 1886.

	PER ANNUM
For Family, household purposes	$5 00
Each Additional Family in same house, supplied with one faucet	3 00
Green Houses.—Special rates.	
Private Stables, for each horse	2 00
Livery Stables, " " "	2 00
Dray and Team Horses, each	1 00
Cows, each	1 00
Stores and Offices	$2 00 to 20 00
Bakeries, average daily use, for each barrel of flour	3 50
Saloons, Groceries and Provision Stores, from	$3 00 to 100 00
Bar, with faucet, from	8 00 to 50 00
Fish Houses	10 00 to 100 00
Slaughter Houses.—Special rates.	
Hotels and Taverns, in addition to family rate, each room	1 00
Boarding Schools, each room	1 00
Public Schools, from	$5 00 to 50 00
Building Purposes, each 1 M brick	5
" " " 100 yards plastering	10
" " " perch stone	1½
Printing Offices.—Special rates.	
Butcher Stalls, each not less than	3 00
Workshops, for 10 persons or under	3 00
" for each additional 10 persons	1 00
Estimated quantities of water each 100 gallons	2
Boarding Houses, in addition to family rate, each boarder	1 00

FIXTURES.

Bath Tubs, for families, 1st tub, $2; each additional	$1 00
Bath Tubs, public, each tub	5 00
Water-closets, for a family, 1st closet, $3 00; each additional, $1 00	$3 00 to 15 00
Water-closets, for Hotels, Stores, Factories, etc., for ten persons, $5 00; each additional person	25
Rod Water-closets, not less than	6 00
Urinals, not less than	2 00
Wash-Hand Basins, for family	$1 00 to 3 00
" " " for other purposes, each person	25
Permanent Wash Tubs	*No Charge.*
Hose, for lawn and street sprinkling purposes	*free.*
Hose, for other purposes	$3 00 to 30 00
Fountains	5 00 to 20 00
Street Sprinklers, each wagon	150 00

Where there is a waste of water a proper increase of rates will be made.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

To the Honorable the Common Council of the City of Detroit:

Gentlemen—The Board of Water Commissioners of the City of Detroit, in compliance with a time-honored custom, respectfully submit herewith a report for the year ending December 31st, 1895.

The extent and importance of the affairs under the management of this Board have required a subdivision and classification of the work, with corresponding heads of departments. These executive officers each year furnish detailed reports, which it is hoped your honorable body will find time to examine. Besides the important report of the General Superintendent and Secretary, carefully prepared statements are submitted by the Civil Engineer, the Superintendent of Gates, the Superintendent of Meters and Inspection, the Chief Engineer at the pumping station, the Superintendent of Grounds, and the Superintendent of Extensions.

A number of extraordinary improvements during the past year require special mention. The most important of these is the construction of a forty-two-inch main, extending from the pumping station in a direct line to Chene street, a distance of 14,000 feet. This main, while largely increasing the supply, will reinforce the pressure of the entire system. Though practically completed, it will not be put into operation until the close of the winter season. The cost of this improvement has been the sum of $180,000. To aid in meeting this expense bonds were issued, as authorized under the act of 1873, in the sum of $100,000. These bonds are payable in 1925, bearing 4 per cent. interest in gold. The premium obtained upon the sale of these bonds was the sum of $11,100, which reduces the interest from 4 per cent. to 3⅝ per cent. The balance of $80,000 required for this main has been met from the general income.

The new Allis pumping engine has been accepted, after a thorough examination and test by experts, and the contract for roofing the engine house with tile has also been finished. Another important piece of work at the pumping station, which was both begun and completed this past season, is the new embankment between the settling basin and the canal. The amounts paid for the balance due upon last year's contracts and the work of this year at the pumping station amount to the sum of $35,000.

The rapid growth of the city and the additional burdens placed upon the pumping department will require constant expansion in the facilities for meeting these demands, and we are compelled to pass over to the coming year obligations for about $30,000 for four new boilers which are to be purchased, and for the necessary apparatus for handling and carrying coal.

A bronze bust of the late Chauncey Hurlbut has been mounted upon an Aberdeen granite pedestal in the memorial gateway. It is fitting that we should gratefully acknowledge the valuable services of Mr. Hurlbut while living and the provision that he has made for a perpetual beneficence. His will equally provides for two objects: the care and improvement of the grounds, and also the maintenance of a library. It is hoped that some arrangement may be consummated by which a branch of the Public Library shall be established at the Park. Many of the larger cities are maintaining branch libraries, giving remote sections convenient opportunities of drawing books from the Public Library. The attractive features of this park and the rapid increase in population in its vicinity give a most favorable opportunity to introduce this method in our city.

We desire to call special attention of your honorable body to the efforts of this Board made during the past year to obtain the passage of a bill in the Legislature providing for the payment of new pipe by abutting property. This bill passed the House, but not the Senate. Under the present system, a large amount of pipe has been laid which is not used by the property through which it extends, and this expense has been unfairly borne by the general consumer. Whatever other methods may be adopted in the future relative to the supply of water, it is hoped that the abutting property act, at the next session of the Legislature, will pass the barriers of both Houses and receive the signature of the Executive.

The Board desire to encourage a wholesome interest in the quality as well as in the quantity of the liquid which it is its province to furnish. The Board of Health and the medical profession should bear a responsibility for the healthfulness of the water supply, and this Board will welcome any information or enlightenment relative to these important matters. Physicians agree, so far as they are agreed upon any one thing, that typhoid is an indication of unwholesome water, while diphtheria is attributed to defective sewerage. Statistics, covering a series of years, show that Detroit has suffered least from Typhoid of any of the lake cities, while Chicago and Toronto have suffered most. The reverse is true of diphtheria, Detroit leading the list. There is nothing in the location of Detroit to prevent its being most healthful. The cities of Holland, notwithstanding the disadvantage of a moist and swampy territory, enjoy the greatest freedom from disease. With extraordinary difficulties in the way of thorough drainage and a satisfactory supply of water, Amsterdam, Rotterdam and The Hague, by sanitary science and enlightened municipal administration, have become model cities of the world in cleanliness and health.

Comparison with other cities places Detroit in the front rank as to its methods and facilities in the supply of water, and, with only one or two exceptions, where the supply is furnished by gravity, our rates are the lowest in the country. Untrammeled by traditions or prejudices, we stand ready to adopt any methods that, after careful examination, are proven for the greater benefit of the people.

In respectfully submitting the foregoing report, we desire to express our appreciation of the uniform courtesy which has been extended by your honorable body to this Board, and for the existing friendly relations.

FRANK E. KIRBY,
ALBERT L. STEPHENS,
DEWITT H. MORELAND,
EDWARD W. PENDLETON,
DARIUS D. THORP.

Board of Water Commissioners of the City of Detroit.

January 2, 1896.

REPORT

OF THE

GENERAL SUPERINTENDENT AND SECRETARY.

January 2d, 1896.

To the Board of Water Commissioners:

Gentlemen—I respectfully submit my report of the general construction and operation of the Works for the year 1895, together with a financial statement of the receipts and disbursements of the Board during the same period.

The disbursements amounted to $645,829.15, and the receipts to $651,545.74.

Included in the disbursements are $50,000 of bonds redeemed in February, and $173,055.77 paid, up to January 1st, for the laying of the new forty-two-inch force main, also the sum of $26,442, charged to pumping works, all of which was expended in completing the contracts for the new engine, engine house, etc., and the removal of the dock between the settling basin and the canal and the substitution therefor of an earth embankment.

Taking the sum of these expenditures, $249,498.12, which are plainly of an extraordinary nature, from the total expenditures, and we have $396,331.03, which represents the expenditures for operation and maintenance and for what may be called ordinary extensions and construction.

Included in the receipts are $100,000 of bonds, sold by the Board, and $12,062.43 premium received thereon. Deducting the sum of these two amounts from the total receipts, and we have $539,483.31, which represents the receipts of the Board from the ordinary resources, and which are in excess of its ordinary expenditures by $143,152.28.

Considering the fact that there are on hand about 1,300 tons of iron pipe, which will so far reduce the expenses for ordinary extensions the coming season, and considering also the fact that the Board has about 3,500 tons of "steamboat" coal, which it can utilize either by its sale or by burning it with an equal quantity of slack, I think the Board can safely calculate upon having for the year 1896 a sufficiently large revenue to meet all of its obligations.

The bonds falling due in the immediate future are $50,000 December 1st of this year and $100,000 April 1st, 1897. The next bonds coming due thereafter are $100,000 September 1st, 1899.

IRON PIPE DEPARTMENT.

The total expenditures of this department, including the $173,055.74 for forty-two-inch force main, was $336,880.59.

With the addition of this new force main, the pipe system for general distribution is so complete that it will need but little, if any, expenditure the ensuing year. During the past year the ordinary extensions, consisting of six-inch, eight-inch, ten-inch and twelve-inch pipe, amounted to 1,890 tons. There is on hand at the present time of these sizes 1,200 tons, and if extensions in 1896 compare, as I think they will, with those of 1895, possibly 1,000 tons would satisfy our requirements. Certainly the estimate made in December of 1,750 tons will be ample.

The keeper of the storage grounds reports to me the saving during the year, made by the Board doing its own hauling, to be $3,698.57. This is arrived at on the basis of the contract for hauling in 1894, and by estimating the expense of feeding and shoeing each horse to be $12 per month.

The Superintendent of Extensions reports to me, upon the completion of each extension, the entire cost thereof in detail, from which reports I am satisfied that notwithstanding the fact that the Board established eight hours to be a day's work, paying the common laborer therefor $1.50, that the expense of laying pipe has not been materially increased on that account. To the fact that the Board employed many men who were really unfit to perform hard labor, but who were citizens in actual need and who could not be refused, may be ascribed any increase over what is usually considered an economical cost.

Connected with this department is the gang of men that was organized in August of 1894 under the charge of John Bridge, which was to have entire charge and control of the valves of the system, and whose duties were to make a systematic examination thereof, to repair valves that were found out of order and to attend to their operation whenever the exigencies of the service might require.

There are about 6,000 gates or valves in the system, and their condition and the frequent breakages that occurred proved that, although they are not of as delicate workmanship as a watch, yet it is almost as necessary in operating them that the men doing so must be as skilled in their workmanship and how to handle them as the watchmaker is of the watch he is repairing.

An examination of their work during the past year will be of interest, and shows how necessary it is to the well-being of our pipe system. It is as follows:

5,128 valves were examined.
671 were found out of order.
623 were repaired.
94 were found shut and opened.
331 were fitted with larger heads to stem.
172 new valves were opened.
59 gate wells were built.
234 wells were rebuilt or readjusted.
147 wells were cleaned.
237 wells were repaired.
170 wood boxes replaced with iron boxes.
31 iron boxes were repaired.
387 boxes were readjusted on account of paving.
1,768 gates were shut and opened for various purposes.
40 blow-offs were repaired.
841 gate wells cleaned of ice and snow.

PUMPING WORKS.

It is with considerable pleasure that I reflect upon the changes made by the Board at the pumping works the past year, more particularly the removal of the fence around the basin, and the substitution for the wood dock between the basin and the canal of an earth embankment. Neither the fence nor the dock were useful or ornamental and it has been my wish for years that they should be done away with.

The abandonment of the stand-pipe and the substitution therefor of relief valves, was another step in the right direction, and when one considers how much more efficiently these simple and cheap mechanical contrivances answer the purposes for which the stand-pipe and tower were constructed, one wonders why it was not thought of before.

As you are aware, the closest attention has been given, for some time, to the subject of the fuel used at the pumping works, and it was because it was estimated that a considerable saving could be effected in this direction that oil was substituted for coal in 1892.

Because of the establishment of the settling basin almost immediately under the smoke-stack, the Board was obliged to burn hard coal for years as a matter of cleanliness. The saving made by the burning of oil as a fuel, as compared to the expense in previous years with coal, will be seen by the following table, and which amounted to over $1,000 per month:

FUEL AT PUMPING WORKS.

YEARS.	GALLONS PUMPED.	COAL.		COKE.		COST.		GAS.	OIL.			TOTAL COST.	COST PER MILLION GALLONS OF WATER.		AVERAGE.	REMARKS.
		POUNDS.	COST.	POUNDS.	COST.	COAL, PER TON.	OIL, PER GALLON.	COST OF.	GALLONS	COST.	GALLONS PER MILLION WATER.					
1887..	13,168,895,808	16,189,641	$35,773 05			$4 40						$35,773 05	$2.71⅜	Coal years.		
1888..	14,380,166,670	17,568,850	39,840 81			4 47						39,840 81	2.73½		$2.68 4/5	As compared with 1893, $2.86⅜. As compared with 1894, $3.03. As compared with 1895, $3 25 4/5.
1889..	12,875,331,453	14,432,128	31,861 22	1,691,780	$2,453 05	4 50						34,314 27	2.68⅛			
1890..	12,120,944,532	15,233,740	31,763 40			4 17						31,763 40	2.62			
1891..	12,057,261,236	2,367,245	5,029 19					$28,705 58				33,734 77	2.79	Gas and coal.		
1892..	12,276,612,482	2,624,288	5,310 00				1.50 cts.	18,217 18	500,255	$7,503 82		31,031 00	2.52 4/5	Oil and gas.		
1893..	13,877,977,208						1.52½"		1,742,720	27,479 93	125	27,479 93	1.98	Oil years.		Pressure increased over "Coal years," 7 per cent.
1894..	13,649,779,605						1.55 "		1,856,861	29,283 47	136	29,283 47	2.14½			Pressure increased over "Coal years," 12⅜ per cent.
1895..	14,693,451,954						1.61 "crude 1.55 " fuel 2.18 "crude		1,929,143	32,095 14	131	32,095 14	2.18⅛			Pressure increased over "Coal years," 20⅜ per cent.

SAVING BY BURNING OIL,

1892.	Estimated	$3,075 89
1893.	Actual	12,303 59
1894.	"	12,075 36
1895.	"	15,792 42
		$43,247 26

The saving effected the past year, as shown by the table, exceeded that of the previous two years by about 25 per cent and is due to the economy of the new engine and to the changes made by Chief Engineer Gould in the arrangement of the pumps in the old engines.

The price of oil, as will be seen in the table, was 1.50 cents per gallon in 1892, 1.52½ cents in 1893, 1.55 cents in 1894, 1.61 cents the first nine months in 1895, and 2.18 cents from October 1st. Our present contract, running from October 1st to April next, is at the latter figure, at which the cost of pumping water is about the same as with hard coal, less the cost of handling the latter. This is shown in the following table:

FUEL AT PUMPING WORKS, 1895

MONTHS.	GALLONS OF WATER PUMPED.	OIL CONSUMED.			PER MILLION GALS. WATER.		Per ct. of Water Pumped by No. 4 Engine.	HEAD PUMPING AGAINST.	REMARKS.
		GALLONS.	COST PER GALLON.	TOTAL COST.	OIL, GALS.	COST.			
January.....	1,272,369,702	171,717	1 55 cts	$2,661 61	Average, $137\frac{1}{10}$. 134½	Average, $2.187 $2.092	42.	$49\frac{6}{10}$ lbs.	
February....	1,432,362,622	195,249	1.61 "	3,133 00	136⅛	2.187	23.	$54\frac{6}{10}$ "	
March.......	1,389,893,894	191,586	1.61 "	3,084 53	137¾	2.222	10.	$51\frac{7}{10}$ "	Crude Oil.
April........	1,121,489,562	160,284	1.61 "	2,580 71	$142\frac{9}{10}$	2.302	....	$49\frac{6}{10}$ "	
May.........	1,186,362,906	158,730	1.61 "	2,533 65	133⅜	2 136	....	$49\frac{1}{10}$ "	Commenced Fuel Oil May 25.
June........	1,362,447,460	171,273	1 55 "	2,654 73	Average, 125⅜. 125¾	Av'ge, $1.943 1.949	23.	54 "	
July.........	1,357,033,857	172,936	1.55 "	2,680 51	127⅜	1.975	17.	$50\frac{7}{10}$ "	
August......	1,257,224,811	150,294	1.55 "	2,329 56	119½	1 853	35.	$50\frac{3}{10}$ "	Fuel Oil.
September...	1,213,320,237	156,177	1.55 "	2,420 74	128¾	1.995	09.	$50\frac{1}{10}$ "	
October......	1,072,860,102	145,410	1.55 " 2.18	2,446 48	135½	2.282	....	49 "	Commenc'd Crude again Oct 26.
November...	959,152,569	119,620	2.18 "	2,607 72	Av., 125⅝. 124¾	2.719	46.	$47\frac{2}{10}$ "	Crude Oil.
December....	1,073,934,232	135,867	2.18 "	2,961 90	126½	2.758	42	$47\frac{5}{10}$ "	
Totals...	14,698,451,954	1,929,867	....	$32,095 14	....	....	....	....	

It will be seen by this table that during the first five months of the year "crude" oil was used, with an average of 137 1-10 gallons consumed for each one million gallons of water pumped. In May, at the earnest solicitation of the contractor, and with the knowledge that the works would be benefited thereby, the contract for crude oil at 1.61 cents per gallon to July 1st was vacated and a new contract for "fuel oil" substituted therefor to October 1st at 1.55 cents per gallon. With "fuel" oil during June, July, August and September, one million gallons of water was pumped with an average of 125 2-5 gallons of oil. During the latter part of October and through November and December, "crude" was again used, with an average of 125 5-8 gallons of oil to a million gallons of water.

At the first glance the natural supposition is that the efficiency of "fuel" is higher than that of "crude," but when it is considered that the new engine was used considerably more in the fuel oil months than previously, that the new arrangement of the pumps by Mr. Gould was effected about June 1st, and that during the colder months of the year steam was used in heating the engine room, the engineer's house and the greenhouse, I think it is safe to say that there is but little difference in the two as a fuel.

In the column of "cost" it will be seen that the cost in December for pumping one million gallons of water with oil at 2.18 cents per gallon, was $2,758, which at 1.61 cents, our former price, would have been $2,062, an increase in the cost of pumping of 33 2-3 per cent.

Considering this fact that at this price, as before mentioned, the cost of pumping water with oil was but little less than with hard coal, and with the knowledge that attachments for the almost complete combustion of soft coal had been successfully manufactured, your honorable body determined to have the four new boilers, for some time contemplated, designed and built for the burning of soft coal, screenings or slack, as might prove most advantageous.

It was estimated, with this arrangement, that our fuel bill, which would amount to over $40,000 annually with oil at 2.18 cents, would certainly be reduced to $25,000, if it would not, as some asserted, be reduced one-half.

The Allis engine was given its final test in July. Mr. George H. Barras, of Boston, was employed by the Board to make the test, and July 24th submitted his report, a synopsis of which will be found immediately after the report of Engineer Gould. He reported, in brief, that the efficiency of the engine exceeds the guarantee of the maker, and upon that report it was accepted by the Board.

AMOUNT EXPENDED ON PUMPING WORKS GROUNDS.

ITEMS.	Previously Expended.	1895.	Total.
Land	$35,000 00	....	$35,000 00
Force Mains	624,008 53	....	624,008 53
Inlet Pipes	90,811 84	....	90,811 84
Dock, Basin and Canal	137,411 02	$9,032 58	146,443 60
Conduits and Wells	81,461 70	....	81,461 70
Engine, Boiler and Coal Houses	192,276 96	4,920 00	197,196 96
Stand Pipe and Tower,	30,420 72	....	30,420 72
Pump Wells	54,221 56	....	54,221 56
Engines	338,694 74	10,828 63	349,523 37
Boilers	54,711 01	....	54,711 01
Engineer's House	8,139 75	....	8,139 75
Sewer	3,666 25	....	3,666 25
Grounds, Fences and Gateway	106,240 35	10,110 60	116,350 95
Inspection	2,977 86	....	2,977 86
Miscellaneous	13,547 67	664 70	14,212 37
Totals	$1,773,589 96	$35,556 51	$1,809,146 47

METERS.

The number of meters attached during the year was 589, making the total in service of 3,775. The report of the Superintendent of that department gives everything concerning the work in detail and contains much that is interesting. He has gleaned certain facts in regard to the death rate of different cities, which he engrafted in his report, and which are valuable information.

The quantity of water passing through meters is 14 5-10 per cent of the whole quantity pumped, and, with 25 per cent taken off from this whole quantity for that which is used for public purposes, for lawn sprinkling and for leaks in the mains, it is 19 5-20 per cent of the balance, or the usable quantity.

The receipts for metered water during the year were $89,392.72, or 20 8-10 per cent of the entire water rates, which indicates that but a small fraction of one cent is received by the Board for each 1,000 gallons of metered, more than is received for the unmetered water, and that as close a correspondence is maintained between the two rates as is possible or right.

The question is often asked, is it fair to "A" to place a meter on his premises and require him to pay for every drop he uses, for every drop he wastes, and for every drop that passes away through leaking pipes and fixtures, when "B," his neighbor, is not metered and, whether he wastes any or not, pays a stated sum the year round. The answer is: It is fair to "A" but not to "B." "A" belongs to a class of consumers of whom we know every gallon they use, both individually and collectively. "B" belongs to a class of whom we know every gallon they use collectively, but not individually. From each class, as above stated, we receive practically the same sum for each 1,000 gallons. If "A" desires to be saving and economical he can do so and get the entire benefit thereof. If "B" desires to be careful and saving he realizes that he gets no benefit therefrom and, there being no inducement for economy, he disregards the fact of running streams and leaking fixtures, because they do not, as he thinks, cost him anything. In other words, the unmetered consumers are tied together, each suffering his share of the expense for the carelessness and wastefulness of any one or all of them. The "B's" are becoming aware of this, and are deserting the ranks of the unmetered consumers for the metered. Five hundred and twenty-nine persons, at their own request, had meters placed on their premises the past year.

EFFECT OF RESTRICTING WASTE.

Inasmuch as it is a fact that water costs directly in proportion to the quantity pumped, and as it is now an admitted fact that running streams do not in the least assist in keeping the sewers clean or in any way effecting the dislodgment of the solid accumulations therein, as has been often claimed, and, further, as there is no other known good purpose that is conserved by supplying a larger quantity than is necessary for the various uses of a community, mechanical, domestic and otherwise, it certainly follows in the interest of economy and good government that the pumping of an excessive amount should be prevented.

Upon this principle the Board in 1889 adopted the policy of introducing meters as rapidly as circumstances would permit, and has pursued the same policy up to the present time.

The following table proves conclusively that where no restrictive measures are used the quantity consumed increases much faster than the population. That this is not due to an increase in the manufacturing interests of the city will appear later on:

HISTORICAL.

YEARS.	Families Supplied.	WATER PUMPED.		REMARKS.
		Total Quantity.	Per Family.	
1852........	......	235,840.275	....	
1853........	4,283	303.531,743	70,868	
1854........	4.619	376,265,126	81.460	
1855........	5,282	542,807.364	102,765	
1856........	5,706	692,124,305	121,297	
1857........	6,189	697,190.523	112,650	
1858........	6,474	718,091,207	110,919	
1859........	6,794	782.112,587	115,118	
1860........	6,750	870.036,451	125,185	
1861........	7,128	895,129,423	125,579	
1862........	7,275	994,945.329	136,762	
1863.......	7,699	1,035,798,043	134,534	
1864........	7,993	1,019,390,256	127,410	
1865........	8,351	1,040,514,887	125,675	
1866	9,089	1,196,317,922	131,622	
1867........	10,242	1,425,535,230	139,186	Average per cent. of increase from 1852 to 1888—12.86.
1868........	11,544	1,666,545.125	144.364	
1869........	12,774	1,946,810,325	152.400	
1870........	13,722	1,866,060,068	136,000	
1871........	14,896	2.300,150.605	154,414	
1872........	16,035	2,782,292,578	173 513	
1873........	17.019	3,198,393,948	187,930	
1874........	18,853	3,289,872,635	174.511	
1875........	19.606	4,207,454,260	214,600	
1876........	20,102	4,065,134,470	200,225	
1877........	20,345	4.213,239,790	207,090	
1878........	20,603	4,345,743,330	210,927	
1879........	21,341	5,129,599,110	240,348	
1880........	22,465	5,552,965,310	247,183	Average per cent. of increase from 1879 to 1888, inclusive, 8.5.
1881........	23,749	6,543,127,968	279,722	
1882........	25,442	6,284,000,742	243,062	
1883........	27,415	7,379,327,788	269,170	
1884........	29,424	8,510,614,140	289,260	
1885........	30,533	9,970,829,580	326,886	
1886........	31,946	10,576,571,254	331,070	
1887........	34,486	13,168,859,808	381,860	
1888........	36,863	**14,380,166,670**	**390,098**	
1889........	39,158	12,875,334,453	328,880	*Commenced Metering.*
1890........	41.467	12,120,944,532	292,300	
1891........	43,933	12,057,261.236	274,470	
1892.......	46,400	12,276,612.482	264,582	
1893........	49,817	13,877,977.208	278,579	
1894........	49.912	13,649,779,605	273 476	
1895........	51,426	14,698,451,954	285,818	

The quantity of water pumped in 1895 was nearly the same as that pumped in 1888, it being but 2 1-5 per cent in advance thereof. The population of the city in 1888 was 194,996 and in 1895 was 266,544, an increase of 36 2-3 per cent, showing an actual increase in the efficiency of the Works of over 34 per cent, that is, upon the basis of the per capita quantity pumped in 1888.

Consulting the table again, it will be seen, in the column headed "Per Family," that this quantity for each family has continually increased, which is the experience of every city in the world, where no restrictive measures prevail. Had these measures not been adopted in 1889 and continued thereafter it is a fact that this ratio of increase would have continued about the same.

This ratio of increase from 1852 to 1888 was on the average 12 86-100 per cent. The average ratio of increase for ten years previous to 1888 was 8 5-10 per cent. To avoid criticism, I will estimate that this ratio of increase since and from 1888 would have been 7 1-2 per cent. With this ratio of increase the following quantities would have been pumped, and consequently the difference between this estimated quantity and that actually pumped will be the amount saved:

SHOWING SAVING IN COST OF PUMPING.

YEARS.	WOULD HAVE BEEN PUMPED, GALLONS.	WAS PUMPED, GALLONS.	SAVING, GALLONS.	COST PER MILLION GALLONS.	SAVING.	REMARKS.
1888.....	....	14,380,166,670	....	......	....	The "cost per million gallons" includes the fuel, labor and everything that enters into the pumping of water.
1889.....	15,458,679,170	12,875,334,453	2,583,344,717	$4 78	$12,348 36	
1890.....	16,618,080,107	12,120,944,532	4,497,135,575	4 49	20,192 11	
1891	17,864,436,114	12,057,261,236	5,807,174,878	4 $39\frac{6}{10}$	25,493 47	
1892.....	19,204,268,822	12,276,612,482	6,927,656,340	4 27	29,581 06	
1893.....	20,644,588,983	13,877,977,208	6,766,611,775	3 35	22,668 14	
1894.....	22,192,933,161	13,649,779,605	8,543,153,556	3 52	30,071 88	
1895	23,857,403,148	14,698,451,954	9,158,951,194	3 52	32,239 50	
					$172,594 52	

The daily average quantity that would have been pumped in 1895 is 65,362,748 gallons.

The daily average that was pumped is 40,269,731 gallons.

The daily per capita that would have been pumped is 245 gallons.

The daily per capita that was pumped is 151 gallons.

To show that this is not an exaggerated estimate, I submit these facts:

In 1888 the daily per capita of Detroit was 204 gallons, and considerably more than that of Buffalo, in fact it led the world. Last year Buffalo, which has not adopted any restrictive measures, pumped a per capita of 293 gallons; and it is not a stretch of the imagination to say that Detroit would undoubtedly have reached, if not exceeded, that figure had no change been made in the policy of the Board.

With this daily per capita, our daily average would have been 78,097,392, with a maximum, which we must always be prepared to pump, of about 115,000,000, to supply which would require two more engines than we now have and an additional force main.

The only possible criticism that can be made upon this estimate made of the saving in pumping alone, is in the taking the rated cost per million gallons in each of the past years and multiplying the increased pumping by it, because it is true that larger quantities can be supplied at a less cost per unit than smaller quantities. Taking off 15 per cent of the estimated amount in the table would fully cover this difference, leaving a saving of $150,000.

The entire expenditures for the purchase, placing and repairs of meters from 1889 to 1895 inclusive, was $133,693.72.

The present valuation of the meters in commission and in stock, with a reasonable percentage off for depreciation occasioned by use, is $94,289.39, showing that the actual expense for maintaining this department was $39,404.33 for the seven years.

The saving effected in the cost of pumping is not by any means the most important one. Large expenditures for machinery, engines, engine houses, force mains, supply mains, etc., etc., have been and always will be prevented by economy of use.

The large force main but now being completed, the new engine, the extension of the engine house, and various other enlargements, were demanded seven years ago. Had not the determination to restrict the waste prevailed with the Board early in the year 1889, these expenditures would have been entered into at that time, and to-day, instead of having a reserve power and capacity more than adequate for our every need, the Board would ere this have entered into another large extension of the Works, in which two engines, an engine house and a force main would have been necessary items.

That the increase in the per capita supply is not due to the increased number of factories and business places in the community, I submit the following table:

YEARS.	No. of Families Supplied.	Rates Received for all Purposes.	Average per Family.	REMARKS.
1876	20,102	$205,624 74	$10 23	$10.21 General Average.
1877	20,345	210,288 12	10 33	
1878	20,603	208,193 95	10 10	
1879	21,341	218,110 13	10 22	
1880	22,465	227,452 73	10 12	
1881	23,749	241,884 32	10 18	
1882	25,442	261,725 79	10 28	
1883	27,415	280,049 06	10 21	
1884	29,424	300,467 24	10 21	
1885	30,533	313,205 10	10 25	
1886	31,946	314,952 31	9 86	Family Rates reduced, taking effect July 1st.
1887	34,486	322,834 59	9 36	$9.36 General Average.
1888	36,863	344,315 26	9 34	
1889	39,158	367,925 27	9 39	
1890	41,467	387,877 73	9 35	
1891	43,933	389,079 97	8 85	Hose tax abated, taking effect July 1st.
1892	46,400	402,534 98	8 67	Meter rates reduced to ⅛ of a cent per 100 gallons.
1893	49,817	420,490 83	8 44	
1894	49,912	418,728 76	8 39	Reduction from July 1, 1894, in charges on fixtures.
1895	51,426	428,772 41	8 34	

For ten years previous to 1886, the rates received for family, business and manufacturing purposes, divided by the number of families supplied, gives practically the same quotient. During that period the same system of rates prevailed. From that time there have been several reductions, all of which, fully applied in 1895, reduced the average received from each family from $10.25 to $8.34, a difference of $1.87, or a general reduction in the income of the Board for the year of $96,166.62.

Previous to and during the first two years of the introduction of meters the average was to each family $9.36. The reduction of the rates in 1891 subsequently reduced this average in 1895 to $8.34, a difference of $1.02 to each family, or a general reduction of $52,454.52 in the income of the Board for the year.

I submit the following comparative statement, taking two years previous to the introduction of meters and the last two years. The actual operating expenses were caused by the increased price of oil and the increased number in the clerical force of the Works:

COMPARATIVE STATEMENT.

	1887.	1888.	1894.	1895.
Daily average consumption in gallons	36,079,068	39,397,716	37,396,656	40,269,731
Daily average consumption per capita	195	204	144	151
Total annual consumption	13,168,859,808	14,388,166,670	13,649,779,605	14,698,451,954
Total consumption through meters	65,182,000	91,750,000	1,788,378,000	2,121,343,600
Revenue from unmetered water	$316,316.30	$335,140.10	$344,877.69	$339,879.69
Revenue from metered water	$6,518.20	$9,175.00	$73,851.07	$89,392 72
Per 1,000 gallons metered water	.10	.10	.041	.042
Per 1,000 gallons unmetered water	.024	.023	.025	.027
Number of families supplied	34,486	36,863	49,912	51,426
Number of service connections	32,938	36,609	47,559	48,918
Miles of pipe	322	325	486	501
Number of meters	About 40	48	3,186	3,775
Actual operating expenses	$82,723.74	$92,402.59	$93,025.22	$107,552 30
*Estimated population	184,829	194,996	258,834	266,545

* Population estimated by multiplying families in city by 5.14.

It will be seen that the per capita quantity pumped increased seven (7) gallons over that of 1894. In analyzing this increase I find that during the first six months of the year the per capita was 160 gallons and during the last six months it was but 143 gallons.

This excessive amount in the first half of the year was almost entirely occasioned by the extreme cold weather in January, February and March. The per capita in February was 192 gallons.

It will give some idea of the vast amount that was wasted at that time by comparing it with November, in which the per capita was only 119 gallons. The difference, 73 gallons per capita, or a daily average pumping of nearly twenty millions, was wasted simply to prevent fixtures from freezing.

It will be seen by the table, also, that for each 1,000 gallons of metered water was received 4 2-10 cents, and for each 1,000 gallons of unmetered water was received 2 7-10 cents. Eliminating from the unmetered water the 25 per cent representing the water used for public purposes, in lawn and street sprinkling, etc., which it includes, and the receipts for this usable quantity is 3 8-10 cents, or but four-tenths less than that for metered water.

I desire to call your particular attention to that portion of the Civil Engineer's report in which he treats of the necessity for more restrictive measures to prevent waste, than at present prevail.

His recommendation to purchase ten (10) of the Deacon meters is one of which I most heartily approve. For two or three years past I have been familiar with the benefits to be derived from their use, but several things have conspired to keep me silent on the subject. The condition of our finances, I think, will now permit us to extend our restrictive measures in this direction, an outlay that will eventually save more than ten times the expense.

The Civil Engineer's treatise upon disease organisms, and the possibility of their existence in the water supplied the city, is of interest to all, and shows a considerable research in a field that is, comparatively speaking, known but little of except by scientists.

While the subject is certainly worthy of consideration, it is yet true that the existence of the evils described is, after all, largely imaginary.

We have a Board of Health in our city whose duties are to regard the public health from every standpoint, to not only guard the city from contagious diseases, but to know their source and cause and to prevent their propagation.

The Board of Water Commissioners has never received from the Board of Health any information, directly or indirectly, that the waters of Detroit River contain germs, either organic or inorganic, that are periling the public health.

I speak of this through a desire to prevent any material expenditure in this direction, unless circumstances demand it.

WATER WORKS BONDS.

The following table gives the entire history of the issue and redemption of the bonds of the Board:

No. of Issue.	Act of	Issued.	Payable.	Amount.	Rate of Interest.	Redeemed.	Outstanding.
1st	1853	Aug. 1, 1853	Aug. 1, 1883	$100,000	7cts.	$100,000	....
"	"	" "	Aug. 1, 1878	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1873	50,000	7 "	50,000	... .
2nd	1855	Aug. 1, 1855	Aug. 1, 1890	100,000	7 "	100,000	....
"	"	June 12, 1855	Aug. 1, 1885	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1880	50,000	7 "	50,000	....
3rd	1857	Aug. 1, 1858	Aug. 1, 1893	150,000	7 "	150,000	....
"	"	Aug. 1, 1867	Aug. 1, 1887	100,000	7 "	100,000	....
4th	1869	Feb. 1, 1870	Feb. 1, 1900	100,000	7 "	....	100,000
5th	"	Aug. 1, 1872	Aug. 1, 1902	50,000	7 "	....	50,000
6th	"	Aug. 1, 1873	Aug. 1, 1903	50,000	7 "	....	50,000
"	1873	Feb. 1, 1874	Feb. 1, 1904	50,000	7 "	9,000	41,000
7th	1869	Aug. 1, 1874	Aug. 1, 1904	50,000	7 "	6,000	44,000
"	1873	" "	" "	200,000	7 "	....	200,000
"	"	June 1, 1875	June 1, 1905	150,000	7 "	1,000	149,000
"	"	June 1, 1876	June 1, 1906	200,000	6 "	1,000	199,000
"	"	Sept. 1, 1880	Sept. 1, 1899	100,000	4 "	....	100,000
"	"	April 1, 1881	April 1, 1897	100,000	4 "	....	100,000
"	"	Dec. 1, 1881	Dec. 1, 1896	50,000	4 "	....	50,000
"	"	Jan. 10, 1895	Jan. 10, 1925	100,000	4 "	....	100.000
				$1,950,000		$767,000	$1,183,000

The following table gives the results obtained from the assessments made last May and June, to commence July 1.

The total number of families in the city was at that time 51,857, which, multiplied by 5.14, the average number in each family, gives a population of 266,544. This average is obtained from the United States census of 1860, 1870, 1880 and 1890.

ASSESSMENT 1895-96.

Dist.	WARDS.	FAMILIES.			Vacant Tenements.	Increase. Decrease —	ASSESSMENT.		
		Supplied.	Not Supplied.	Whole Number.			1895-96.	Increase. Decrease—	Transf'rd to Meter Rolls.
1	Ninth.......	5,336	10	5,346	135	199	$27,874	$381	$361
	Fifteenth...	2,800	62	2,862	81	100	18,547	1,570	285
	Totals ...	8,136	72	8,208	216	299	46,421	1,951	646
2	Eleventh ...	3,504	7	3,511	145	23	20,459	— 387	948
	Thirteenth..	2,522	18	2,540	71	73	15,004	357	165
	Totals ...	6,026	25	6,051	216	96	35,463	— 30	1,113
3	First........	2,557	5	2,562	150	64	25,057	— 232	948
	Seventh	3,299	12	3,311	196	64	18,381	— 119	615
	Totals....	5,856	17	5,873	346	128	43,438	— 351	1.563
4	Third.......	3,256	9	3,265	89	49	19,181	— 276	676
	Fifth........	3,778	12	3,790	109	108	21,484	161	485
	Totals ...	7,034	21	7,055	198	157	40,665	— 115	1,161
5	Second	2,041	6	2,047	161	31	24,049	— 460	1,017
	Sixth........	3,575	6	3,581	183	143	24,488	134	733
	Totals ...	5,616	12	5,628	344	174	48,537	— 326	1,750
6	Tenth.......	4,094	7	4,101	138	58	25,094	507	261
	Fourteenth.	2,304	31	2,335	116	45	13,713	361	104
	Totals ...	6,398	38	6,436	254	103	38,807	868	365
7	Fourth	3,107	3	3,110	187	76	25,255	— 229	825
	Twelfth	3 173	4	3,177	155	104	18,820	768	2.7
	Totals ...	6,280	7	6,287	342	180	44,075	539	1,042
8	Eighth......	3,400	3	3,403	157	242	23,008	1,072	414
	Sixteenth...	2,680	236	2,916	128	135	14,863	145	661
	Totals ...	6,080	239	6,319	285	377	37,871	1,217	1,075
	Aggregate	51,426	431	51,857	2,201	1,514	$335,277	$3.753	$8,715

FINANCIAL REPORT

BY THE

SUPERINTENDENT AND SECRETARY

FOR THE YEAR 1895.

RECEIPTS.

Water Rates Account.—	
Rates paid	$ 428,772 41
Percentage Account.—	
From delinquents	7,633 01
Penalties for shutting off	440 00
Plumbers' License Account.—	
Paid for licenses	559 45
Service Connections Account.—	
Labor and material	5,404 07
City of Detroit Account.—	
Tax levy	73,201 90
Repairing Leaks Account.—	
Labor	180 41
Office Account.—	
Rebate	1 93
Iron Pipe Account.—	
Labor and materials	12,130 68
Bonus paid for extensions	1,776 46
Hurlbut Fund Account.—	
Payments from trustees	4,000 00
Material sold	1 88
Real Estate Account.—	
Rentals	2,450 00
Meters Account.—	
Sale of material	371 79
Interest Account.—	
On deposits general account	2,318 17
On deposits sinking fund	115 30
Bonus on bonds	12,062 43

Bonded Indebtedness account.—	
Bonds sold	$100 000 00
Horse and Wagon Account.—	
Sale of horses	75 00
Pumping Works Account.—	
Material sold	10 00
Pumping Water Account.—	
Ice and material	40 85
Total receipts	$651,545 74

EXPENDITURES.

FOR CONSTRUCTION.

Iron Pipe Account.—	
Superintendent and clerks	$ 12,076 57
Labor	140,424 61
Iron pipe	121,624 90
Special castings	11,543 97
Tools and repairing of	2,347 67
Derrick charges	382 30
Lumber	2,718 21
Coal	374 84
Hauling	211 67
Oil	119 00
Packing	465 55
Shortage on pay roll	1 00
Pumps and furnaces	231 79
Lead	6,140 87
Paint, etc	270 79
Repairs and material for	462 78
Repaving	9,118 09
Street car and toll tickets	377 00
Livery	97 00
Wagon and harness supplies and repairs	637 60
Feed	2,677 54
New track and repairing	437 58
Farrier	474 27
Materials	2,076 97
Stationery, books, etc	254 86
Medical services	255 00
Horse board	158 50
Shavings	148 90
Fine	2 00
Veterinary services	201 65
Valves	13,433 03
Freight, express and telegrams	30 70

Gate wells and boxes	$4,724 35	
Typewriting	6 25	
Real estate (lot)	775 00	
Painting and papering house	45 00	
Refund	241 00	
Funeral expenses	97 00	
Gravel	190 50	
Beams	274 08	
Stove, etc	8 31	
Lot privileges	201 00	
Claims for injury	250 00	
Resodding	3 00	
Gutters, etc	46 40	
Bicycle	75 00	
		$336,714 10
Pumping Works Account.—		
Labor	$ 996 44	
Supplies—Matches, soap, etc	12 50	
Materials	380 45	
Tile roof	4,920 00	
Machines and repairs	876 91	
Payments on engine	8,000 00	
Dock and embankment	9,032 58	
Indicator gear	25 00	
Testing engine	1,126 32	
Changing platform	667 90	
Rent for steamer Ward	250 00	
Expenses to Chicago, chief engineer	21 75	
Railings	132 50	
		$26,442 35
Meter Account.—		
Superintendent and labor	$ 6,647 89	
Meters	9,235 11	
Freight and express	53 15	
Specials and fittings	709 36	
Horse board and shoeing	225 25	
Repairs to harness and vehicles	64 67	
Street car and toll tickets	10 21	
Hauling	21 75	
Veterinary services	1 00	
Material—Brass, solder, lumber, etc	366 73	
Tools and repairing of	10 57	
Printing stationery and postage	33 97	
Meter wells	191 97	
Repairing pavement	16 22	
		$17,587 85
Real Estate Revenue and Expense Account.—		
Insurance	$ 290 81	

Repairing sidewalk	$83 74	
Plumbing	125 00	
Replastering in hall	13 63	
Labor	165 86	
Material	267 53	
		$946 57
Real Estate Account.—		
Building shed	$ 458 00	
Improvements at storage yard	2,058 63	
Platform	1,300 00	
Heating apparatus	250 00	
Material	248 16	
		$4,314 79
Engineering Account.—		
Civil engineer and assistants	$ 7,442 64	
Material, instruments, etc	914 79	
		$8,357 43
Horse and Wagon Account.—		
Horses	$ 790 00	
Harness	180 00	
Vehicles and parts thereof	1,519 00	
		$2,489 00
Office Furniture and Fixture Account.—		
Furniture and fixtures	$ 1,301 65	
		$1,301 65
Aggregate		$398,153 74

OPERATION AND MAINTENANCE.

Office Account.—	
Secretary, assessors and clerks	$ 25,487 00
Watchman and janitors	1,725 50
Printing and binding	1,172 20
Advertisements and subscriptions	108 58
Supplies—Soap, matches, etc	53 13
Supplies—Stationery, etc	816 51
Furniture and fixtures	30
Extra services	903 64
Fuel	27 10
Light	394 60
Postage and telegrams	232 40
Germicide	18 00
Ice	17 10
Street car tickets	40 00
Horse board	195 00
Farrier	34 35
Harness and buggy repairs	13 00
Horse, harness and wagon supplies	17 25

Express charges	$ 1 05	
Livery	11 25	
Entry fee	8 00	
Safe rental	10 00	
Veterinary services	2 00	
Telephone rent	709 92	
Premium on guaranty	402 50	
Electric light repairs	5 05	
Entertaining Columbus visitors	127 50	
Insurance, boiler	90 00	
Fees	6 00	
		$32,628 93
Pumping Water Account.—		
Engineers and firemen	$ 16,625 57	
Consulting engineer	1,140 00	
Fuel oil	32,652 21	
Coal	68 97	
Stationery	18 29	
Supplies—Rags, waste, soap, etc	158 61	
Supplies—Valves, gaskets, packing, etc.	327 49	
Boiler and machine repairs	612 75	
Lubricants	484 97	
Horse goods	2 85	
Farrier	8 00	
Commutator	35 00	
Street car tickets	10 00	
Boiler inspection	54 50	
Demurrage	2 00	
Frames	23 00	
Electric light repairs	66 17	
Freight and telegrams	4 36	
Ice	37 04	
		$52,331 78
Water Rates Account.—		
Overcharge returned	$ 12 25	
		$12 25
Percentage Account.—		
Labor	$ 2,508 00	
		$2,508 00
Repairing Leaks Account.—		
Labor	$ 11,530 42	
Wagon and harness repairs	84 03	
Feed, board and supplies	31 85	
Farrier	121 25	
Street car and toll tickets	69 00	
Repairing tools	35 57	
Tools and materials	233 34	
Repairing pavement	263 10	

Telephone rent	$ 1 25	
Damage by water pipe	250 00	
Meals	3 75	
		$12,623 56
Service Connections Account.—		
Labor	$ 7,865 47	
Cart and harness repairs	235 55	
Cocks and valves	2,621 18	
Farrier	52 00	
Toll tickets	1 00	
Material and repairs	93 26	
Refund to plumber	2 50	
Hospital services	3 00	
Blankets	35 20	
		$10,909 16
Inspection Account.—		
Labor and material	$ 3,750 00	
		$3,750 00
Meter Repairs and Expenses Account.—		
Fittings, etc	$ 1,495 58	
		$1,495 58
Aggregate		$116,259 26
Bonded Indebtedness Account.—		
Bonds paid	$ 50,000 00	
		$50,000 00
Interest Account.—		
Interest paid	$ 72,301 99	
		$72,301 99
Hurlbut Fund Account.—		
Superintendent, librarian and labor	$ 5,105 58	
Plants, trees, flowers, fertilizers, etc.	51 87	
Tools and material	379 90	
Street car tickets	10 00	
Farrier	6 05	
Plans and specifications	64 76	
Tent	20 00	
Books	40 00	
Memorial gateway (part)	1,968 30	
Gravel	500 25	
Crushed stone	668 80	
Settees	297 50	
Expenses to Plymouth	1 15	
		$9,114 16

RECAPITULATION.

Construction expenditures	$398,153 74
Operation and maintenance expenditures	116,259 26
Bonded Indebtedness	50,000 00
Interest	72,301 99
Hurlbut fund	9,114 16
Aggregate	$645,829 15

ACTUAL OPERATION EXPENSES.

The actual operating expenses are the foregoing expenditures for operation, less the credits by cash received for said expenditures, and are as follows:

Office account	$ 32,628 93	
Less receipts	1 93	
		$32,627 00
Pumping water	$ 52,331 78	
Less receipts	40 85	
		52,290 93
Repairing leaks	$ 12,623 56	
Less receipts	180 41	
		12,443 15
Service connections	$ 10,909 16	
Less receipts	5,963 62	
		4,945 64
Inspection		3,750 00
Meter repairs and expense account		1,495 58
Total		$107,552 30

RECEIPTS OF WATER RATES BY DISTRICTS.

YEAR.	1st District Wards 9 and 15.	2d District, Wards 11 and 13.	3d District, Wards 1 and 7.	4th District, Wards 3 and 5.	5th District, Wards 2 and 6.	6th District, Wards 10 and 14.	7th District, Wards 4 and 12.	8th District, Wards 8 and 16.	Meters.	Aggregate.
1885-6	......	$2 50	......	......	......	......	......	......	......	$2 50
1886-7	......	5 00	......	......	......	......	......	......	......	5 00
1888-9	......	......	......	......	......	......	......	......	......	......
1889-90	......	......	......	......	......	......	......	......	......	......
1890-1	......	......	$3 50	......	......	......	......	......	......	3 50
1891-2	......	......	......	$2 50	......	$2 50	......	......	......	5 00
1892-3	$13 75	2 50	10 25	2 50	$6 75	28 25	$3 75	$9 00	......	76 75
1893-4	49 35	36 75	96 25	31 75	122 50	104 15	64 42	98 16	......	603 33
1894-5	22,315 27	17,302 78	20,979 58	20,034 04	25,576 65	19,641 51	22,181 00	18,992 13	......	167,022 96
1895-6	24,323 98	18,021 16	21,954 63	20,337 22	25,159 01	19,619 70	22,453 42	19,791 53	*$89,392 72	261,053 37
Total..	$46,702 35	$35,370 69	$43,044 21	$40,408 01	$50,864 91	$39,396 11	$44,702 59	$38,890 82	$89,392 72	$428,772 41

* Meter receipts from January 1, 1895, to January 1, 1896.

Notwithstanding the reduction of the rates which took effect July 1st, 1894, prevailing, of course, the entire year of 1895, the water rates received were in excess of those of 1894 by about $10,000.

The water rates that will be received in 1896 will probably be in excess of those of 1895 by about $15,000, should no change be made in the present schedule of rates.

This report, gentlemen, is respectfully submitted, together with a report of the financial operations of the employees of the Board, prepared at my request by the Auditor, and which is attached.

Yours, very respectfully,

L. N. CASE,
Superintendent and Secretary.

CERTIFICATE OF AUDITOR.

L. N. CASE, *Superintendent and Secretary:*

Dear Sir—In accordance with your request, I furnish herewith a consolidated statement of the financial operations of the employees of the Water Board for the year 1895.

H. S. STARKEY, METER CLERK.

I have examined the accounts of the Meter Clerk, from January 1st, 1895, to July 1st, 1895. Meter bills amounting to $41,946.94 were collected and same passed in full to Receiving Clerk.

J. E. LONG, PERMIT CLERK.

The total receipts from service cocks, sleeves, valves and plumbers' licenses, from January 1st to July 1st, 1895, as proven by examination of receipts issued, was		$2,781 45
Receipts from delinquent taxes were:		
Year.		
1891-2	$ 2 50	
1892-3	34 75	
1893-4	379 17	
		416 42
Total		$3,197 87

The books of the Receiving Clerk show that amount above has been received in full.

ASSESSORS' DISTRICTS 1 TO 8 INCLUSIVE.

In addition to the monthly examination of the receipts of the eight Assessors, the result of which has been reported to the Board, I have made an examination of their assessment books for the year July, 1894, to July, 1895, making a careful analysis of the treatment of every assessment on the books.

I find the work of the Assessors remarkably correct, and furnish below a consolidated report of same.

Assessment 1894-5, Dist. 1 to 8 inclusive	$331,524 00	
Gains (increased assessments)	17,727 44	
Cash paid to receiving clerk		$334,887 67
Losses (assessments reduced)		10,981 27
Delinquent rates		3,381 75
District No. 1—Cash over	50	
District No. 2—Cash over	3 75	
District No. 3—Cash over	50	
District No. 4—Cash short		1 25
District No. 5—Cash over	50	
District No. 6—Cash short		3 00
District No. 7—Cash balanced		
District No. 8—Cash short		1 75
	$349,256 69	$349,256 69

MEMORANDUM.

Three assessors short in cash	$6 00
Four assessors over in cash	5 25
Net shortage	75

GEO. E. KUNZE, RECEIVING CLERK.

The total receipts of the Receiving Clerk from all sources for 1895, were as follows:

January,	1895	$ 71,846 50	
February,	"	15,118 24	
March	"	23,777 31	
April	"	177,458 04	
May	"	21,002 88	
June,	"	25,866 43	
July,	"	99,338 36	
August,		69,425 97	
September,	"	28,896 14	
October,	"	72,292 92	
November,	"	19,891 26	
December,	"	26,631 69	
		$651,545 74	
Cash on hand January 1, 1895		5,978 94	
			$657,524 68

With bank deposits as follows:

January,	1895	$ 68,960 14
February,	"	21,812 05
March,	"	19,921 08
April,	"	173,887 06
May,	"	28,060 17

June,	1895	$23,095 45	
July,	"	93,528 87	
August,	"	77,954 98	
September,	"	23,954 67	
October,	"	68,954 98	
November,	"	28,019 18	
December,	"	22,813 25	
		$650,961 88	
Cash on hand January 1, 1896		6,562 80	$657,524 68

The sources of the foregoing receipts were as follows:

Water rates		$428,772 41	
Percentage	$ 7,633 01		
Shuts	440 00		
		8,073 01	
Service connections	$ 5,102 50		
Service connections (material sold)	301 57		
		$5,404 07	
Plumbers' license		559 45	
City of Detroit (tax levy)		73,201 90	
Iron pipe, material sold	$ 10,640 68		
Iron pipe, bonus	3,266 46		
		13,907 14	
Repairing leaks, material sold		180 41	
Pumping water, material sold		40 85	
Meter account, material sold		371 79	
Real estate, rev. and exp.		2,450 00	
Interest acct. (acct. bank dep.)	$ 2,433 47		
Interest acct., bond bonus	12,062 43		
		14,495 90	
Horse and wagon acct.		75 00	
Hurlburt fund		4,001 88	
Pumping works, material sold		10 00	
Office acct., rebate		1 93	
Bonded indebtedness, bonds sold		100,000 00	
			$651,545 74

CASH STATEMENT, YEAR 1895.

1895.	Dr.		
Jan. 1st.	Cash on hand	$ 5,978 94	
	Commercial National Bank, General Fund	38,922 76	
	Commercial National Bank, Secretary's Fund	500 00	
Dec. 31st.	Receipts 1895	651,545 74	
			$696,947 44

1896.	Cr.		
Jan. 1st.	Cash on hand	$ 6,562 80	
	Commercial National Bank, Balance General Fund	43,555 49	
	Commercial National Bank, Balance Secretary's Fund	1,000 00	
	Disbursements, 1895	645,829 15	
			$696,947 44

I certify to the correctness of the Receiving Clerk's accounts, as above.

Disbursements have been made through the Secretary's office as follows:

January,	1895	$ 92,918 05	
February,	"	41,142 64	
March,	"	45,634 94	
April,	"	58,760 30	
May,	"	70,143 70	
June,	"	69,721 64	
July,	"	49,538 19	
August,	"	57,492 94	
September,	"	40,865 14	
October,	"	52,134 20	
November,	"	29,751 56	
December,	"	37,725 85	
			$645,829 15

The above disbursements were debited to the following ledger accounts:

Iron pipe	$336,714 10
Meters	17,587 85
Service connections	10,909 16
Engineering	8,357 43
Office	32,628 93
Pumping water	52,331 78
Repairing leaks	12,623 56
Meter repairs and expenses	1,495 58
Percentage	2,508 00
Inspection	3,750 00
Hurlburt Fund	9,114 16
Interest	72,301 99
Horse and wagon	2,489 00
Office furniture and fixtures	1,301 65
Real estate rev. and ex	946 57

Real estate	$ 4,314 79	
Bonds redeemed	50,000 00	
Pumping works	26,442 35	
Water rates (refund)	12 25	
		$645,829 15

In connection with the foregoing disbursements, I desire to state that I have made a careful examination of all vouchers, monthly, before the passage of same by your honorable body, and hereby certify to the correctness of the foregoing.

Respectfully submitted,

J. A. M. MORETON,
Auditor.

Detroit, January 2, 1896.

REPORT OF THE CIVIL ENGINEER.

Detroit, January 25, 1896.

To the Honorable Board of Water Commissioners of the City of Detroit:

Gentlemen—In compliance with the regulations of your honorable body, the Civil Engineer submits the following annual report for the year 1895:

The year just closed has, for several reasons, been a notable one in the history of our Works. Perhaps the event that will be viewed with the most interest by those conversant with the mechanical principles involved in the operation of water works and the hitherto accepted *dicta* regarding them, is the disconnecting of the stand-pipe June 2, thereby leaving this a direct pressure system in the simplest form, without reservoir, stand-pipe or balancing tank, dependent simply upon relief valves for protection against excessive variations of pressure. Ten years ago, and by many even now, such a proceeding would have been looked upon as inviting calamity, yet during the past seven months, under more severe requirements than ever before, the same engines that have served us from ten to twenty years have run on without interruption, and the testimony of their engineers is that even when two engines are running in one main, they operate more smoothly than while the stand-pipe was connected.

The year is further remarkable from the immense quantities of water consumed at various times and for its total consumption, which has exceeded that of any previous year. During 1895 the quantity of water recorded pumped by the engines has been 14,698,451,954 gallons, an increase of nearly 8 per cent over the quantity pumped in 1894. For the twenty-four hours from 7 a. m., February 8, to 7 a. m., February 9, there was pumped 60,532,971 gallons, which is the largest quantity ever pumped here in the same length of time. On Saturday, July 6, between 5 and 6 p. m., there was pumped 2,981,934 gallons, which is the maximum amount ever pumped in a single hour. The last two statements give a key to the explanation of our increased consumption for the year, and its causes are to be found in the exceptional meteorological conditions which have existed at various times. A careful study of the fluctuations of our water consumption carried on during the past three years has shown certain relations which exist between temperature and precipitation and the demand for water. Briefly, the results of these investigations may be summarized as follows:

For a range of temperature from about the freezing point to about 50 degrees above zero, Fahrenheit, variations of temperature appear to exert no influence upon consumption, but any change above 50 degrees Fahr. will affect consumption, and it will increase rapidly as the temperature rises; and as it falls will decrease more slowly than it increased. Below 32 degrees Fahr. variations of temperature will affect consumption, which increases rapidly as the temperature falls, and decreases less rapidly as it rises, being unlikely to reach the normal until the temperature gets to be somewhat above the freezing point. Above 50 degrees Fahr. precipitation will have a sudden and very marked effect to reduce consumption, having in one instance decreased ours as much as 12,000,000 gallons in a single day, but below 50 degrees Fahr. it appears to exert no influence.

Considering the excessively cold weather of the winter months and the very hot, dry periods of the early summer in view of the above deductions, the addition to our consumption is readily explained. On the other hand, for no month since November, 1892, has so small a quantity of water been pumped as in the November just past, and the hourly records for those periods when our consumption is least, from midnight to four in the morning, remain at as low a figure as they have been at corresponding times during the past three years.

The small extent of pipe laid of the smaller sizes, twelve-inch and under, also distinguishes this year. While during the four years 1891 to 1894 inclusive the average quantity laid in these sizes has been over 183,000 feet, during 1895 only 96,000 feet were laid; and, finally, the construction of a third force main from the Works to town marks an epoch in the history of our system. This main is now nearing completion, and when in service will contribute materially both to relieve our machinery from the severe strains to which it was subjected by the excessive demands of the past season, and to raise the head in those districts where its increase is most needed. It was discovered last July, at those periods when our engines were pumping nearly three million gallons per hour, that the frictional loss amounted to over 34 per cent of the work done by the engines. When pumping two million gallons per hour the frictional loss was only 21 3-4 per cent. It had already been found that two-thirds of the frictional losses occurred in the two forty-two-inch force mains. Therefore, with the third main in service, we may expect that the resistances in the force mains when delivering three million gallons hourly will be the same as at present when delivering two million gallons; or comparing two-thirds of the above percentages, the new main will reduce our frictional losses from 34.4 per cent to 26.1 per cent of the total work done. This will mean on the average about a three-pound increase of pressure over the entire system, being somewhat more in the eastern part and less in the western.

On the afternoon of July 6, when the maximum quantity of water was pumped, an investigation was made of the condition of the distribution in the district between Canfield avenue and the North Boulevard from Cass avenue west, which district the sixteen-inch main laid in 1894 was intended to relieve. The examination, which extended over nearly 7,000 feet of territory from south to north, being at right angles to the supposed direction of flow, beginning at a thirty-inch main and terminating at a twenty-four-inch main, including eleven pressure readings, showed that the variation of total head across the district was only two and three-fourths feet, and the smallest usable head recorded was nearly twenty-eight feet. It may be of interest to compare the pressures existing at the time of this investigation, which was at a time of most severe demand upon the distribution, with those of eight years ago, as follows:

	1888.	1895.	Gain.
Canfield ave., from Cass to Third....	11½ lbs.	18 lbs.	56 %
Hancock ave., from Cass to Third....	9 lbs.	15 lbs.	66⅔%
Warren ave., from Cass to Third....	9 lbs.	14½ lbs.	61 %
Putnam ave., from Cass to Third....	8¼ lbs.	14 lbs.	69 %
Holden ave., from Cass to Third....	8 lbs.	12 lbs.	50 %

Increase of head at engines, about 30 per cent.

From this it is seen that for each pound pressure added at the engines the consumers in this locality have had two pounds extra delivered to them, and very similar results might be shown elsewhere in our system.

Early in the past season some discussion took place regarding the quality of our water supply and the advisability of moving the intake from its present location to a point further up the river. As there appeared to be no reliable information then at hand that would aid in settling the questions raised, your engineer was requested to investigate, as far as possible, into what might be the sources of present and future contamination likely to affect our water supply, and what remedies or preventives might be applied. Since that time an extensive study has been made of the recent literature bearing upon the subject of water pollution and the treatment of polluted waters. A visit was made to the Lawrence Experiment Station, conducted by the State Board of Health of Massachusetts, where since 1886 there have been carried on the most careful and extensive experiments and investigations on water purification that have yet been undertaken anywhere in the world.

So far as chemical analysis is able to determine, our water compares most favorably with that of any public water supply in America, which fact has been frequently commented upon, and considering the inert matters only it may be said to contain nothing at all likely to prove disagreeable or deleterious to public health. Fifteen years ago to have said this would have been saying that the water was as near perfection for domestic purposes as any water known, but the developments of more recent investigation have proven that chemical analysis alone can afford no criterion of the healthfulness of a drinking water, and that the mineral matter and the dead organic matter which such a water contains are entirely harmless to the extent to which they ordinarily occur, while it is to the presence of certain minute living organisms, now believed to be the true germs of many diseases, that the harmful effects of some waters are due. These organisms are so small, many of them, that even the microscope is unable to distinguish them, and it is only by delicate and special methods that they can be identified. Organisms of this sort are found in all surface waters, and very frequently, if not always, in even very deep well waters. Fortunately for us, not all, nor even a large percentage of them are harmful. Of those which grow and thrive in ordinary waters none are known to be dangerous, but there are varieties not indigenous to the water, but which are capable of living for a greater or less period of time in it, that are disease producing. Such, for instance, are the germs of cholera and typhoid fever. These germs are given off in the dejecta of those afflicted with these diseases, and if they are permitted to mingle with sewage which finds its way into a stream farther on used as a water supply, the disease may be thereby transmitted. As the former of these diseases is little feared in America, only very limited investigations have been carried on regarding it here, but in Europe it was clearly and conclusively proved that the terribly fatal epidemic which visited Hamburg in 1892 and 1893 was caused by the transmission of cholera germs through the water supply. Typhoid fever has been much more extensively studied, and though it is an old theory still maintained by some that it is caused by an environment imperfectly ventilated and drained, the bulk of authority, though admitting that imperfect sewerage and bad ventilation in his surroundings may and often do tend to render the subject particularly liable to infection, maintains the conclusion that typhoid fever is not in the original case produced from such causes. The most frequent sources of typhoid infection in those localities where especially thorough and painstaking investigations have been carried on are water and milk supplies. In one noted case raw oysters were proven to have caused the disease, and uncooked vegetables, such as lettuce and celery, have been looked upon as possible agents for its conveyance.

In considering any water supply it is therefore necessary to ascertain whether it is possible for the dangerous or pathogenic bacteria to gain access to it and whether their vitality is such as to enable them to live until they have traversed the distance between the source of contamination and the consumer of the water. To this end some knowledge of their life is needed. The typhoid bacillus has been perhaps more extensively studied than any other, and its term of life in Merrimac River water at Lawrence was found to range from ten to thirty days, the average period being about fifteen days, while in the purer effluents of some of the filters it appeared to be somewhat longer. There is excellent proof that typhoid germs traveled thirty-nine miles in the Merrimac River, over mill dams, through rapids and almost stagnant mill ponds, the last thirteen miles being affected by tide water, and after passing through pumps and water mains caused an epidemic among the water consumers, and there is abundant evidence of their similar transmission over shorter distances.

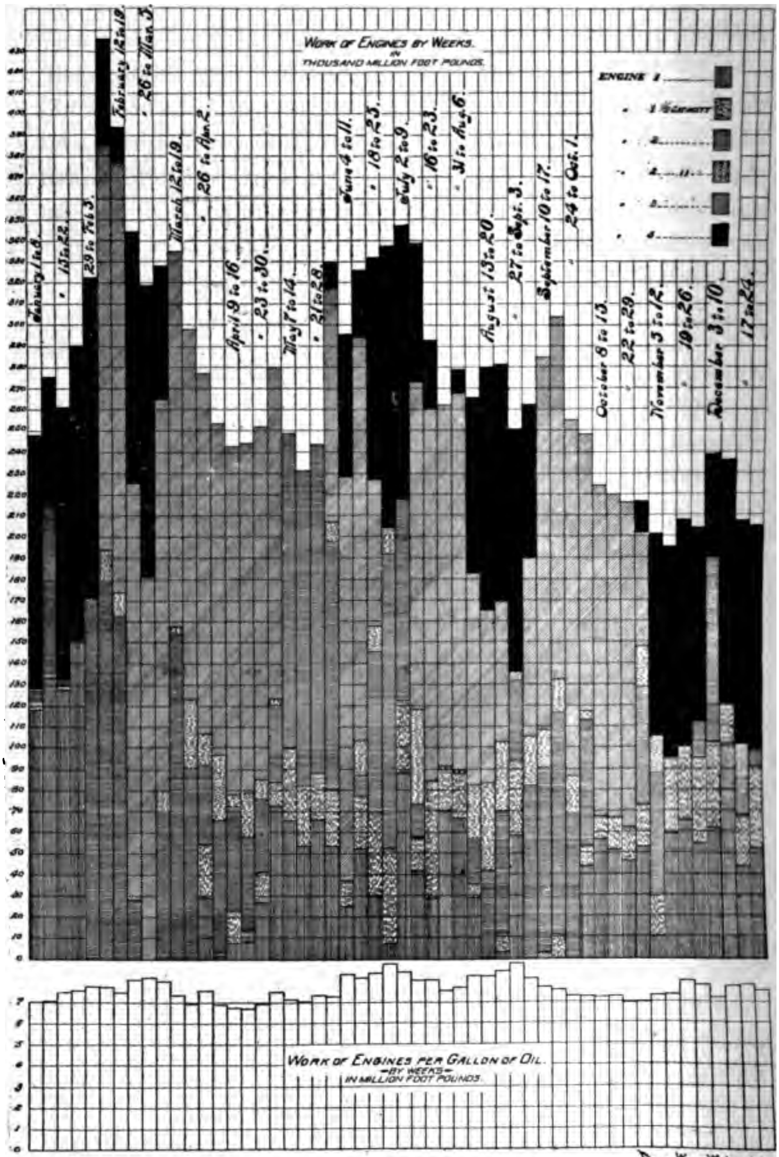
In view of these facts, a consideration of the quality of our water supply must include the investigation of all sources from which such contamination can reach it. The most likely sources of typhoid infection of Detroit River water are the sewage discharges of the cities above us on St. Clair River. Port Huron being the largest of these, and the most of a city in its appurtenances, delivers the greatest quantity of sewage into the river, but its distance being so great, about sixty miles, it hardly seems probable that it can have much direct effect upon the water at Detroit. Yet St. Clair, Marine City and The Flats, as well as other towns, take water from St. Clair River and Lake St. Clair below Port Huron, and discharge their sewage into the same waters. It may, therefore, be possible that typhoid germs starting at Port Huron should cause disease at St. Clair, and from there be transmitted by stages to our intake. A more dangerous, though less constant, cause of pollution is found in the discharges of sewage from passing vessels, and viewing these two sources of contamination alone, it does not appear that any advantage would be gained by moving the intake up stream from its present location. The writer does not wish to be understood as saying that there is any proof of a single case of typhoid having been caused in Detroit from the above sources of infection, but is only pointing out a possibility. Another source of pollution, and the one most commonly considered, is the discharge of Connor's and Fox Creeks and several county ditches entering Lake St. Clair within three miles of the intakes. Of these, Connor's Creek is the largest and the nearest at hand, being only about one mile from the suction cribs. The drainage area of this stream and the ditches near it is about fifty square miles, with about 5,000 inhabitants, or 100 per square mile. Were such a population on the watershed of an impounding reservoir where water was stored for a considerable period before use, it would not be considered particularly dangerous. The Fox Creek watershed and the lake shore within Wayne County adds about twenty-five square miles more, having probably not to exceed eighty-five inhabitants per square mile. Being so sparsely settled, it does not seem likely that serious contamination could reach us from these sources, except under particular conditions. Thus far there are practically no sewers emptying into these streams, and at periods of ordinary flow it seems very doubtful if the waters of Connor's Creek, at least, can become sufficiently mingled with those of Detroit River, in the short distance they have to flow, to reach our intakes. It is only at times of heavy rains and the melting of snows that much dangerous matter would be at all likely to gain access to these streams. The character of the soil in this vicinity renders it extremely likely that at such times the water would reach these channels mainly over the surface, carrying with it whatever it found in its way, and at such times the higher velocities of the currents certainly causes these waters to mingle more thoroughly with those of our river, and undesirable matters may thus reach our intakes. There is very little chance for the water to improve in passing through our system, for ordinarily in less than twenty-four hours from the time the water enters the suction crib it is delivered to the consumer. That fevers apparently of water origin are often quite prevalent after heavy rains following periods of drouth, and after spring freshets, has been noted by some of our physicians. In view of this, it seems to your engineer that your honorable body should exercise a careful surveillance over these tributary waters and use all possible influence to prevent them from becoming the receptacles for sewage from any sources, particularly the villages on their watersheds. The Act of Incorporation of the Board of Water Commissioners provides, in Section 21, that your honorable body may exercise authority over the waters of Detroit River and Lake St. Clair within six miles of the intakes, to prevent pollution, but considering the facts already pointed out, this is not sufficient to insure our water supply from contamination as the populations above us increase. Whatever the conditions now, in the more or less distant future Detroit will be forced to follow the example of the European cities having surface water supplies and purify its water before delivering it to the consumer. It is to be regretted that we have no reliable analyses furnishing us a clue to the true composition and contents of our water, and I would respectfully urge the advisability of having frequent biological and bacteriological analyses made by a reliable authority, as such a method would afford us most readily with information from which the true condition of affairs could be appreciated.

Whether our supply be now infected or not, it must be apparent that the existence of such conditions as are discussed above should admonish us to lose no time in endeavoring to reduce to a minimum the useless consumption of water, for aside from the bearing upon the present cost of operation, the cost of purification varies almost directly with the quantity purified. The subject of the restriction of waste is an old one in these Works, and much has been already done in that line, but much more, and the hardest part, remains to be accomplished before the consumption can be brought within those limits which present practice holds to be sufficient for all necessities. For the past three years your engineer has been devoting much attention to the consideration of this subject. Hourly records of the quantity of water pumped and the pressures maintained have been furnished this office since May, 1893, and from the reports furnished us by the Fire Department we have been able to obtain a reasonably accurate determination of the quantity of water used at fires for the entire year just closed. Memoranda collected by our own Meter Department give us the amount of water used for manufacturing and business purposes, which is checked by the difference between weekday and Sunday consumption. By applying the rules already laid down for temperature and precipitation effects, under some conditions it is possible to determine the quantity of water used for lawn and street sprinkling, preventing freezing, etc., with fair accuracy. To thoroughly discuss the subject of waste would require an amount of space far beyond the compass of this report, but it is possible to outline some of the methods of determining the various quantities desired. The month of November may usually be considered a normal month, there being ordinarily no demand for water either for lawn and street sprinkling or to prevent freezing. With the fire consumption and that for manufacturing and business purposes determined and subtracted from the total quantity pumped, the remainder represents domestic consumption, waste and leakage. November, 1895, furnishes the following information:

Average daily per consumer consumption by plunger displacement	122.23 gals.
Average daily per consumer fire, business and manufacturing consumption	23.36 gals.
Average daily per consumer domestic consumption, waste and leakage	98.87 gals.

From observations of the Meter Department, compared with our revenue statistics, your engineer determined that the average necessary daily domestic consumption would be about twenty-two gallons per consumer. If this figure should be correct, the waste and leakage must amount to 76.87 gallons per consumer daily. All will admit that during the hours from midnight to four in the morning the consumption of water in a city of even this size should be comparatively insignificant. Now, the smallest quantity pumped in a single hour in the past two years was between twelve and one o'clock on the morning of November 11, 1895, and amounted to 832,525 gallons. This is at the rate of nearly 20,000,000 gallons daily, or 76.4 gallons per consumer. This must be nearly all waste and leakage, and coincides very closely with the 76.87 gallons obtained above, and gives proof that the estimate of twenty-two gallons per person for domestic needs was very nearly correct. The average daily consumption for the past year has been about 40,250,000 gallons, and of this we find that almost 20,000,000 gallons are being wasted at that time of year when there is the least cause for waste to occur. Or, considering the month

Plate 1.



[illegible] Works, 1893.

November alone, over 60 per cent of the water pumped appears to be serving no useful end. In the month of February the total daily consumption per consumer was 198.3 gallons. The average daily metered and fire consumption was twenty-two gallons, leaving 176.3 gallons for domestic uses, waste and leakage. During the maximum day the quantity used was at the rate of 234.6 gallons per consumer, of which the minimum hourly night rate was 223.3 gallons daily. In July the daily consumption per consumer was 168.2 gallons, of which 23.4 gallons were metered and fire consumption. Taking the year as a whole, the records of this office give the following information regarding consumption:

	Yearly. Gallons.	Daily. Gallons.	Daily, per Consumer Gallons.
Business and manufacturing, schools, etc., by meter	2,121,343,600	5,811,900	22.35
Domestic—household and culinary purposes	2,088,129,230	5,720,902	22.00
Lawn and street sprinkling and cooling purposes	1,064,000,000	2,915,070	11.20
To prevent freezing pipes	698,000,000	1,912,330	7.40
Public purposes—Hospitals, cemeteries, asylums, fountains, sewer flushing, police and fire engine houses	365,000,000	1,000,000	3.84
Fires—From water mains only	10,596,000	29,000	0.12
Total useful consumption	6,347,068,830	17,389,102	66.91
	Gallons.	Gallons.	Gallons.
Recorded consumption, 99% of plunger displacement	14,698,451,954	40,269,704	154.85
Correction for slip of pumps and error of register, 10%	1,469,845,195	4,026,970	15.48
Net recorded consumption	13,228,606,759	36,242,734	139.37
Useful consumption as above	6,347,068,830	17,389,102	66.91
Waste and leakage	6,881,537,929	18,853,632	72.46

In common language, allowing as free use of water for lawn and street sprinkling and to prevent freezing as was indulged in during the past year, and considering all as useful consumption, with all that used for business, manufacturing, schools, fires, public purposes and domestic needs

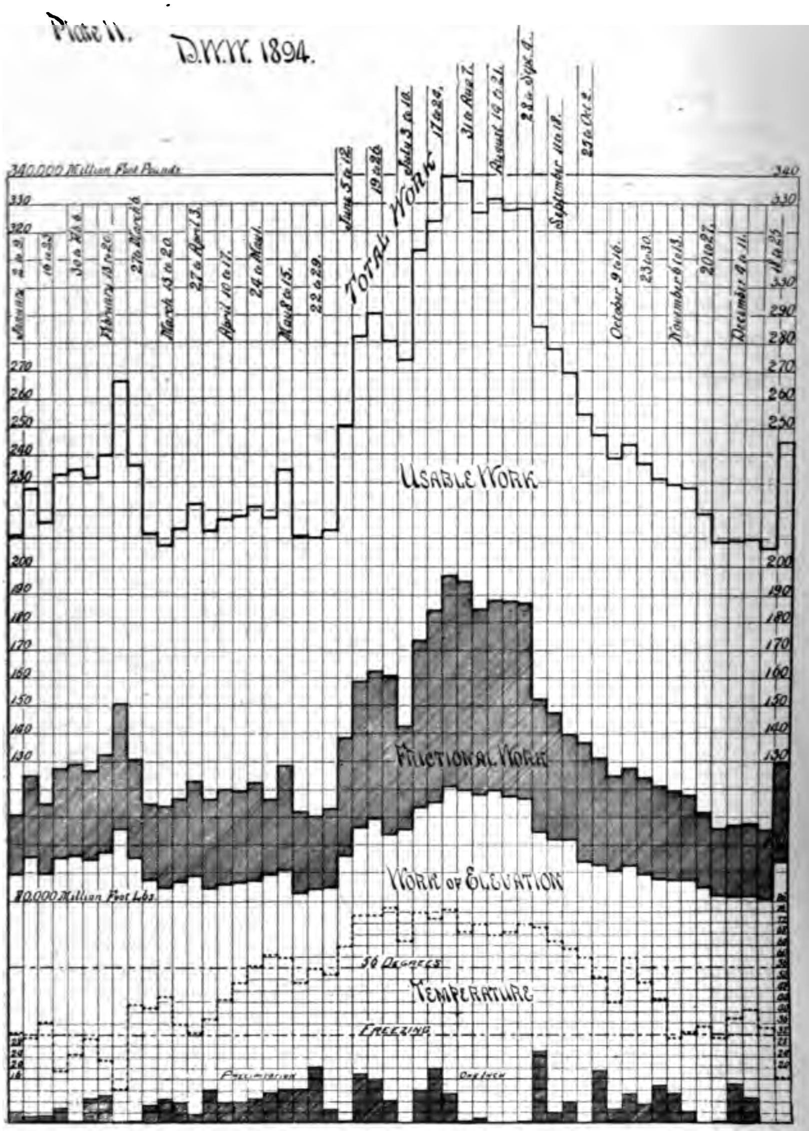


Plate 11.
D.W.W. 1894.
340,000 Million Foot Pounds
January 2 to 9.
16 to 23.
30 to Feb. 6.
February 13 to 20.
27 to March 6.
March 13 to 20.
27 to April 3.
April 10 to 17.
24 to May 1.
May 8 to 15.
22 to 29.
June 5 to 12.
19 to 26.
July 3 to 10.
17 to 24.
31 to Aug. 7.
August 14 to 21.
28 to Sept. 4.
September 11 to 18.
25 to Oct. 2.
October 9 to 16.
23 to 30.
November 6 to 13.
20 to 27.
December 4 to 11.
18 to 25.
Total Work
Usable Work
Frictional Work
Work of Elevation
70,000 Million Foot Lbs.
56 Degrees
Temperature
Freezing
Precipitation
One Inch
340
330
320
270
260
250
240
230
200
190
180
170
160
150
140
130

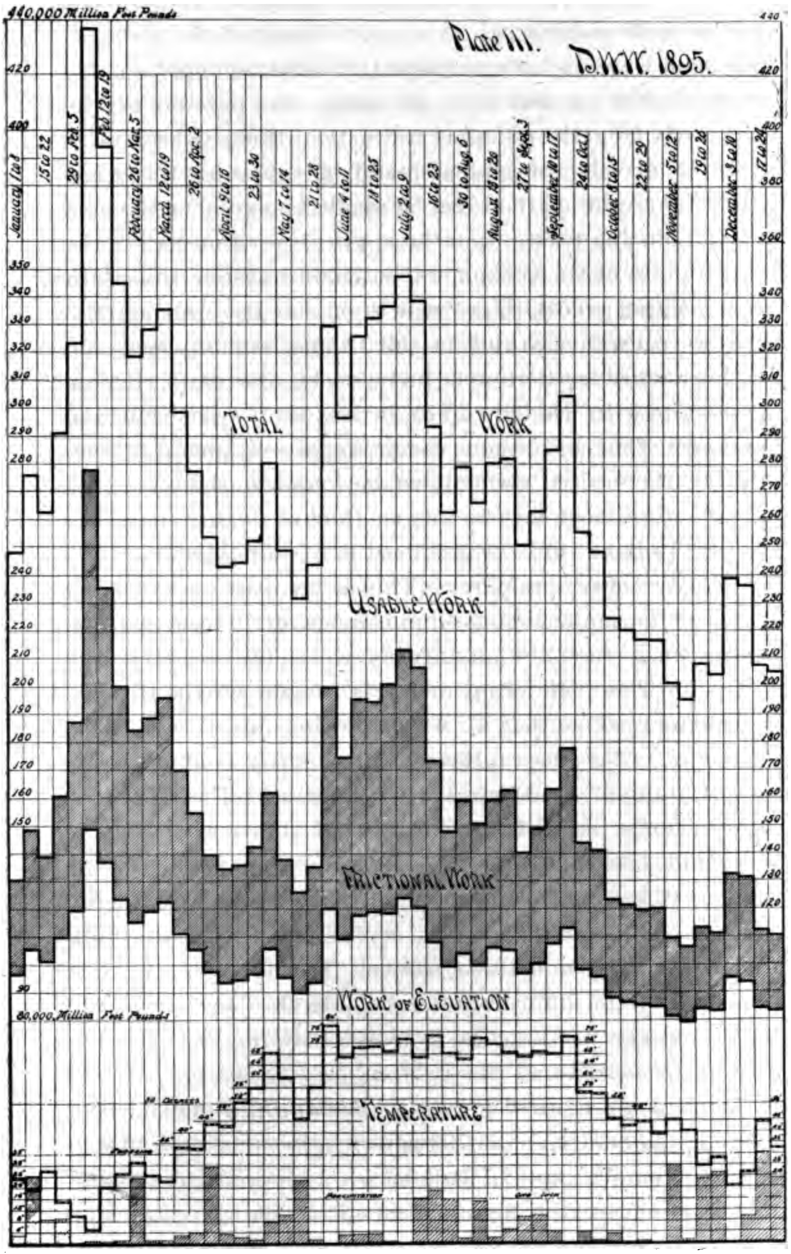
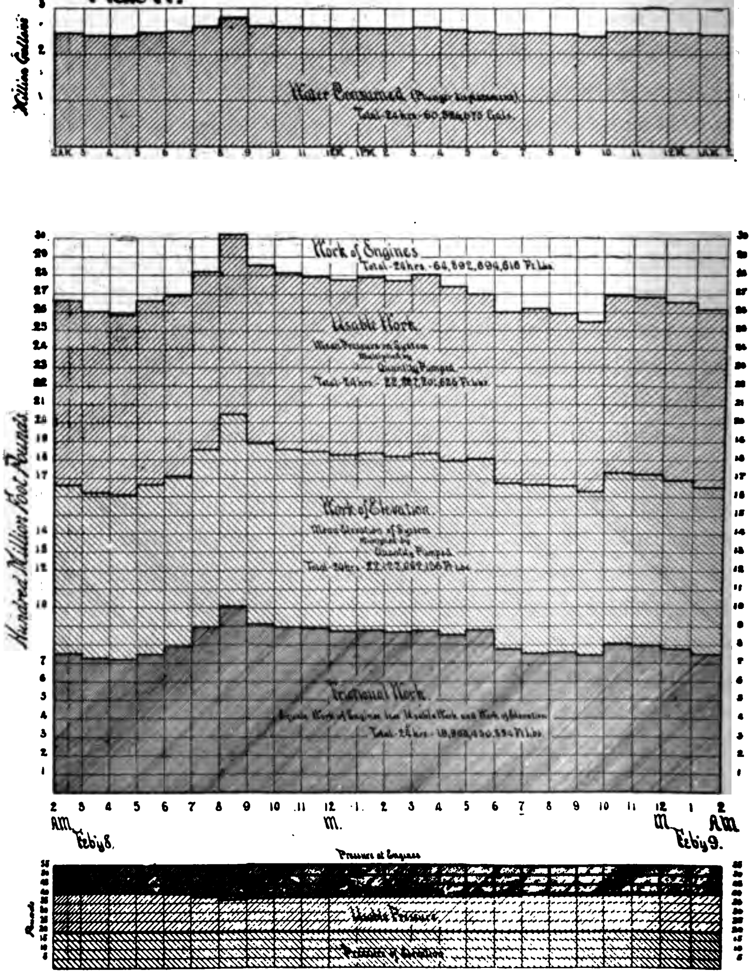


Plate III.
D.W.W. 1895.
440,000 Million Foot Pounds
80,000 Million Foot Pounds
January 1 to 8
15 to 22
29 to Feb. 5
Feb. 12 to 19
February 26 to Mar. 5
March 12 to 19
26 to Apr. 2
April 9 to 16
23 to 30
May 7 to 14
21 to 28
June 4 to 11
18 to 25
July 2 to 9
16 to 23
30 to Aug. 6
August 13 to 20
27 to Sept. 3
September 10 to 17
24 to Oct. 1
October 8 to 15
22 to 29
November 5 to 12
19 to 26
December 3 to 10
17 to 24
TOTAL WORK
USABLE WORK
FRICTIONAL WORK
WORK OF ELEVATION
TEMPERATURE
50 Degrees
Freezing
Precipitation
One inch
440
420
400
380
360
350
340
330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
90

added, *for every gallon so usefully consumed more than one and one-tenth gallons ran to waste.* If any of the water so consumed were usefully employed, no effort should be made to restrain its use, but as no advantage can possibly accrue to anybody from the pumping to waste of this great quantity of water, decisive measures should be taken for its reduction. When the method can be applied, none is more effective in reducing waste than the application of meters to the service pipes of the consumers, but in our system this work is not keeping pace with the growth of the city. During 1895 there were nearly two and one-third times as many new connections added as there were meters set. Out of 48,918 connections now in use only 3,775, or less than 8 per cent, are metered. That some more comprehensive means of accomplishing the desired result must be found is, therefore, apparent. The most satisfactory method of dealing with the problem in hand thus far produced is by the aid of the Deacon Waste Detection Meter. This is an instrument which is set in the main, and mechanism operated from a clock records on a chart the quantity of water passing it at any moment. The mode of operation is to shut off the district to be examined, so that all water flowing into it must pass the meter. The observations are ordinarily conducted between midnight and four in the morning. The inspector goes through the district shutting off the service connections and side lines and recording the time each gate or valve is closed. By comparing these memoranda with the chart of the meter the amount of waste at each connection and in each street main is shown. The inspector is then possessed of the information regarding the location of the waste and all that remains is to see that the defective fixtures are repaired and the leaks in the mains stopped. On the application of this system in Boston, in a district containing a population of 21,760 persons, the consumption was reduced from 58.5 to 37.7 gallons per capita daily, a saving of 35.6 per cent, the night consumption being reduced 58 per cent. Similar results have attended the use of these meters in Philadelphia and in many cities in England. The cost of the meters set in place in Boston was about $400 each. I would respectfully recommend to your honorable body that ten of them be purchased and set in our system at points to control those districts in which excessive waste and leakage is most to be expected. The great advantage of using these meters over ordinary inspection is that the inspector's time is not taken up in visiting premises where there is no waste and the residents thereby uselessly annoyed, but he is able to devote his whole attention to those which need it. If our consumption during 1895 had been reduced only to 100 gallons per consumer, or about 35 per cent, the saving in fuel alone would have been over $13,000, or more than 40 per cent of the entire fuel bill, the same pressures being maintained on the system.

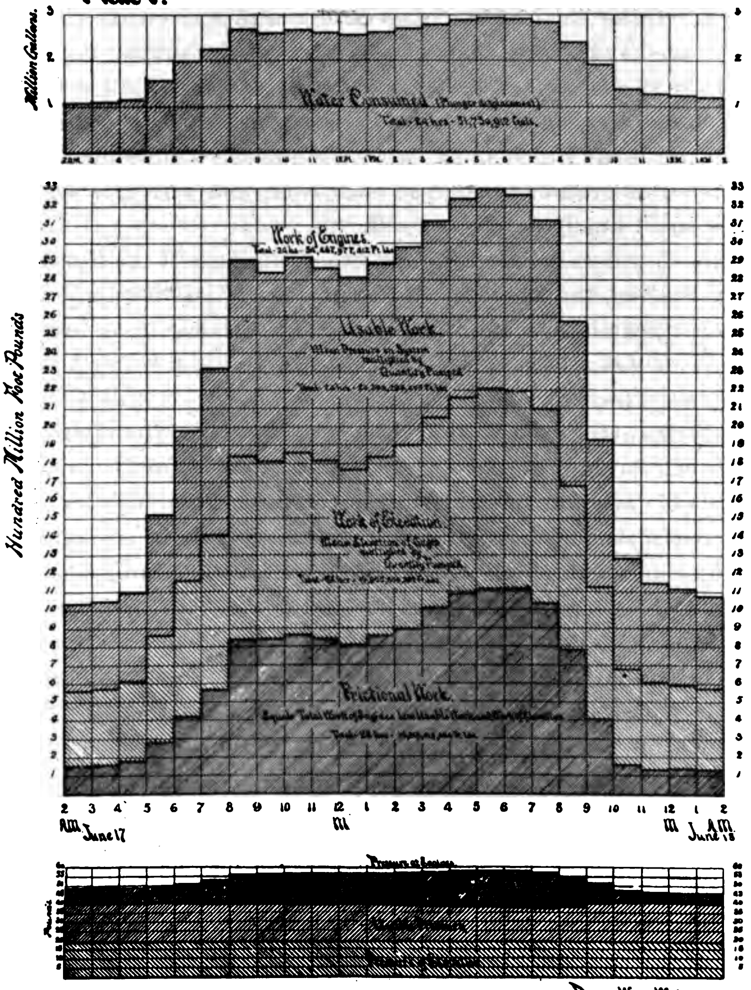
In a city having so many miles of electric railway in operation as this it may be anticipated that trouble will be met with from electrolysis. This subject has been very extensively studied in and about Boston, but in spite of the pains taken with the investigations, the results thus far have failed to resolve the preventing of electrolytic effects in general into a soluble problem. It has been, however, observed that very small currents—even with as low a potential as 0.002 volt—are capable of producing dangerous effects, and that the constituents and amount of moisture in the soil appear also to have an important bearing on the case. While it has been frequently attempted in Boston to locate points of electrolytic action, and many excavations have been made to find the effects of it, none have resulted in the discovery of anything definite or conclusive in the matter. The most that can be said is that certain conditions tend to produce certain effects, but these effects are not always apparent in the presence of the conditions. Regarding our own system, we know that so far as the electric currents are concerned we have all the conditions required to produce electrolysis in our pipes, but thus far we have found no direct evidence that our mains are affected. The

Plate IV.



Detroit Water Works, 1893.

Plate V.



Detroit Water Works, 1893.

most natural explanation is that the requisite constituents are lacking in our soil to produce the necessary chemical combinations, or it may be that the waste in the system being so great, a means of waste detection will be necessary to determine the location of electrolyzed pipe, even after the damage has been extensive. The study of the subject is one for the specialist, and so long as no general remedy is known, it does not seem wise to spend time or money in searching for a trouble which must, with our present knowledge, be treated as an individual case each time, and which, if serious, must finally manifest itself.

As shown in the report of the Chief Engineer of the Pumping Station, the efficiency of our machinery has been about 16 per cent higher than last year. This is due to at least three causes: First, the economy of Engine No. 4, the Allis engine, which has done 20 per cent of the work this year, thereby saving us about 7 per cent of the cost of pumping; second, the improvements to Engines Nos. 1 and 2, which probably account for about 6 per cent more; and, third, the increased head pumped against, allowing a more economical use of steam, probably accounts for the remaining 3 per cent. The effect of the running of Engine No. 4 is clearly shown on Plate I., page 54, where the work done weekly by each engine is represented in the upper diagram, and the quantity of work done per gallon of oil burned weekly is shown on the lower diagram. A correction has been applied to the quantity of oil used to allow for the lighting, but no correction for the heating of the buildings has been made. It will be seen that whenever Engine No. 4 does a fair percentage of the pumping there is a decided increase in the work of a gallon of oil. This plate also brings out the increased economy as the total quantity of work increases, which occurs with increasing head.

It was hoped at the beginning of the year that the new force main might be completed in sufficient time to enable the distribution system to show a corresponding gain, but this has not been the case. In consequence of the increased consumption of water the work of the distribution shows a decrease of efficiency of about 4 per cent, leaving the net increased efficiency of the system as a whole 12 per cent, and, as before stated, two-thirds at least of this loss was due to the force mains being too small. The work of the system as a whole for 1894 is shown on Plate II., page 56, and that for 1895 on Plate III., page 57. These plates are made to the same scale, and the difference in the demands made at various times upon the system are at once apparent. Particular attention is called to February and June. Plate IV., page 60, shows the work of the system by hours for the day of maximum consumption, February 8, and Plate V., page 61, the same for June 17, which was a day of very large hot weather consumption. While in the former there were pumped nearly nine million gallons more water than in the latter, from the concentration of the demand into a few hours it is clearly seen that the summer day made by far the more severe tax upon the machinery and distribution. Under normal conditions, as shown in Fig. 1, Plate VI., page 64, the consumption and the work falls off gradually after reaching its maximum between nine and eleven o'clock in the morning; but in the case of summer consumption the area included in the hump of the diagram from noon until eight p. m. represents work consumed in lawn sprinkling. The quantity of water so used on June 3 last, as may be seen from an examination of Fig. 2, Plate VI., and of Plate VII., page 66, was 12,000,000 gallons, being nearly 25 per cent. of the entire daily consumption. In the former diagram the quantity of work expended for lawn and street sprinkling and cooling purposes on that day is represented by the dark area and was obtained in the following manner: The temperature for June 3, as shown by the full line in the lower part of the figure, was exceptionally high and as will be seen by reference to the middle diagram of Plate VII., page 64, followed a week of very hot, dry weather, this being in fact the hottest week of the year. The work of the engines by hours for June 3 is represented by the area enclosed by the

Plate VI.

Figure 1.

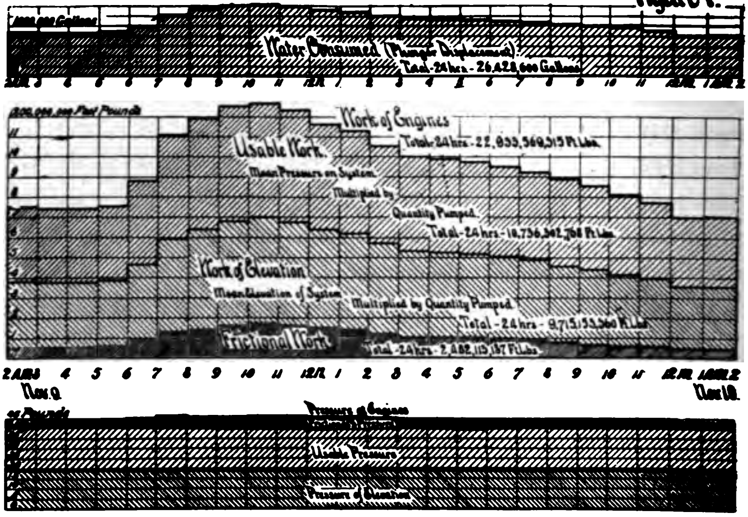
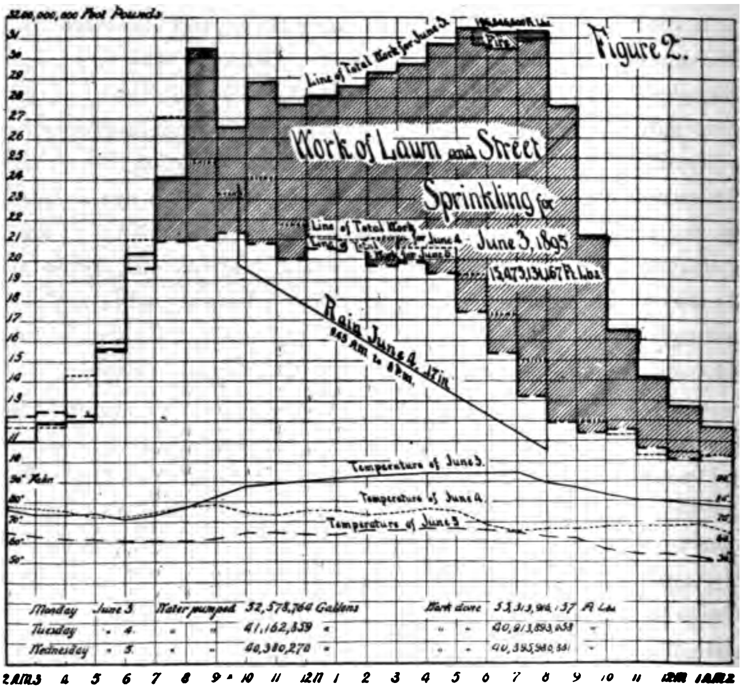


Figure 2.



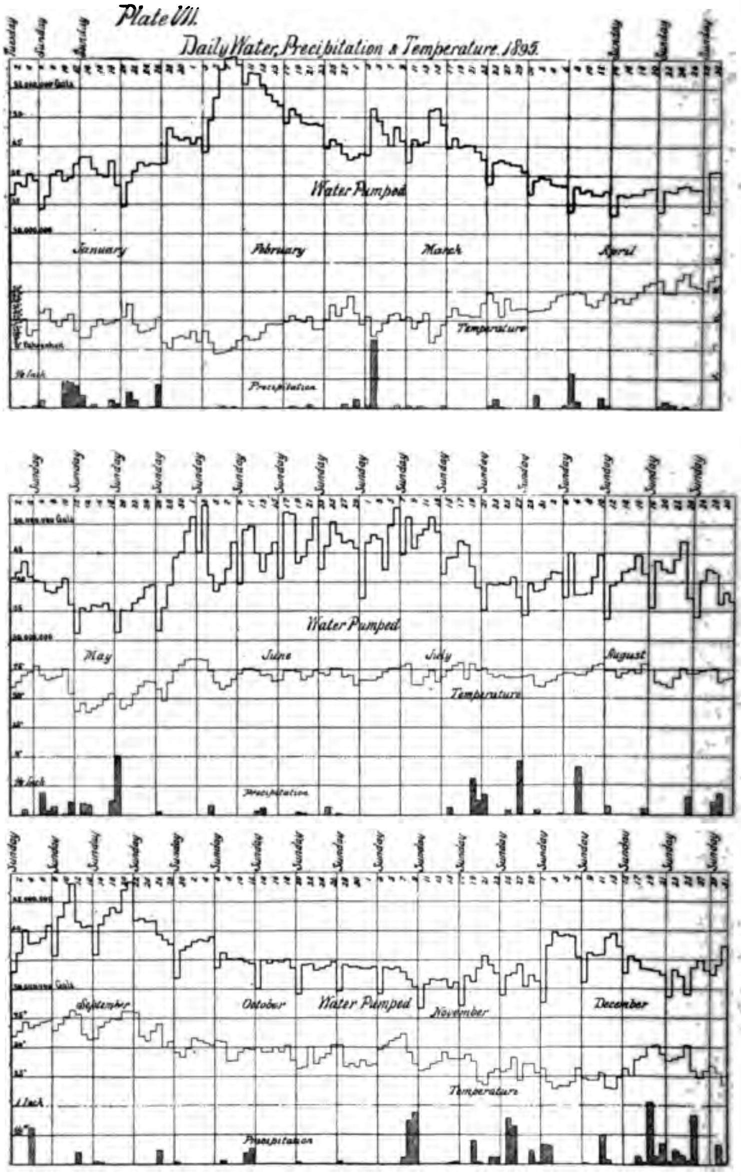
Monday	June 3.	Water pumped	52,578,764 Gallons	Work done		53,313,916,157	Ft. Lbs.
Tuesday	" 4.	"	"	41,162,359 "	"	"	40,913,893,658	"
Wednesday	" 5.	"	"	40,380,270 "	"	"	40,395,980,581	"

D.W.M.

full heavy line of the diagram. June 4 opened with higher temperature and increased consumption, as is shown by the dotted lines of temperature and work, but at 9:45 a. m. rain began to fall. The effect of this was presaged by the sudden decrease of the demands upon the engines after 8 o'clock. The rain continued until 8 p. m. of that day, and though the total precipitation was less than one-quarter of an inch, it was accompanied by a fall of temperature from a maximum of 96° on the third to a minimum of 50° on the morning of the sixth. The work of the engines for June 5 is represented by the area below the broken line bounding the dark area. It seems clear that the only uses of water likely to be affected by a rain and such a fall of temperature are those for lawn and street sprinkling and cooling purposes, and hence any decrease of consumption or work at such a time must be due to a cessation of these uses. It will be at once appreciated that not all the water so used was shut off, but whatever difference there is between the consumption of June 3 and that of June 5 that is not accounted for by incidental causes, as fires and the day of the week fluctuations, may be fairly ascribed to the causes under consideration. Making corrections for the work caused by the fire between 5:30 and 8 p. m. of June 3, shown by the area marked "Fire," when four engines were in service, and for the usual nightly variations between Sunday and week nights, the diagram shows 13,475,131,167 foot pounds, or more than one-third of the average daily work for the year, and nearly two-thirds of the work of the day of minimum consumption (shown in Fig. 1, Plate VI.) as due to these causes. The use of such a quantity of water at times when every additional gallon means the bringing of our machinery so much nearer to the limit of its endurance leads to the consideration of whether some means of regulation bearing upon it should not be introduced. It is certain that the use of water for lawn sprinkling without charge has led to considerable abuses. It is not an uncommon thing to see a hose running with full head, the nozzle lying on the

Plate VII.

Daily Water, Precipitation & Temperature. 1895.



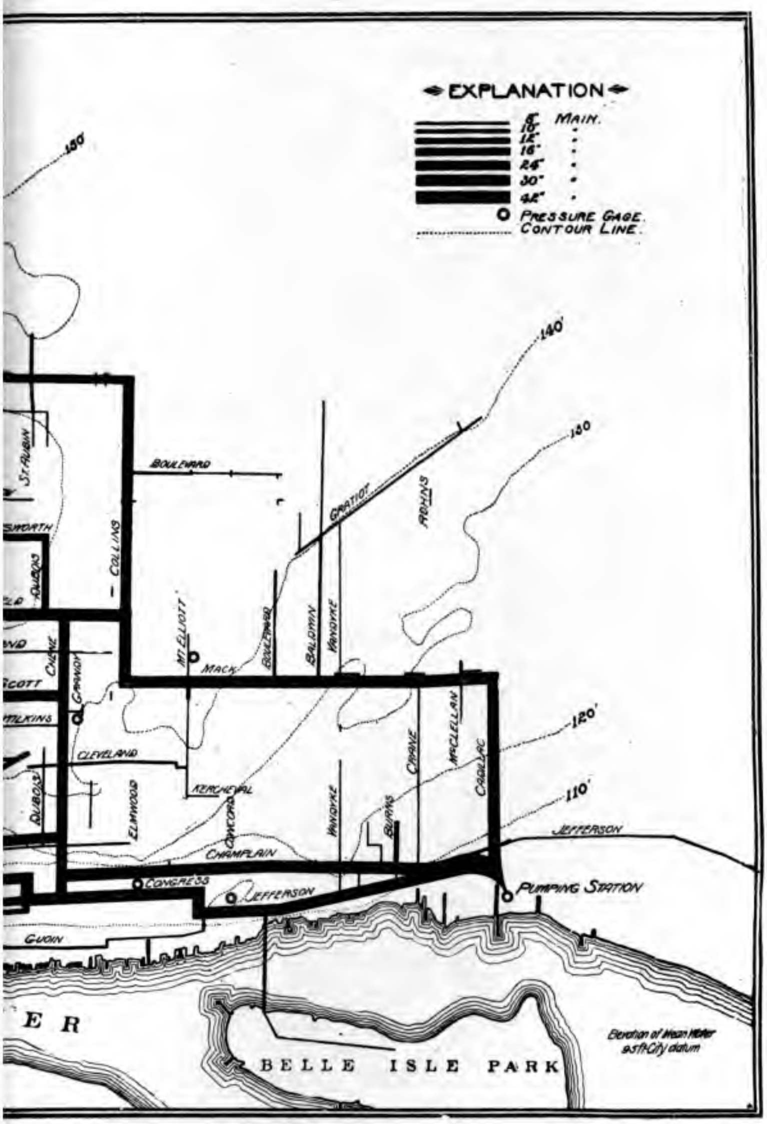
sidewalk or thrust into a crack between the boards. Such waste of water is almost criminal. Upon the right means to apply in the solution of this problem it is hard to decide, but something should be done. A considerable relief might be obtained by restricting the size of nozzle used and limiting the minimum length of hose. If the lawn sprinkling could be confined to the night, the draught on the machinery would be much reduced and the lawns improved as well, for it is a wise provision of nature that veils the sun at times of rain. As things are now, should our lawn sprinkling continue to increase for another year as rapidly as it has done in the past, we will be forced to purchase additional machinery to meet this demand alone, while if it be properly controlled, even though other causes of waste be not abated, the present machinery may be relied upon to do our work for several years to come. This system having no reservoir to fall back upon in times of accident or emergency, must always have an extra engine to put into service. In the ordinary course of operation one engine is necessarily undergoing repairs, so that only three can be in commission continuously, of which one should be in reserve. There were times during the past summer when three engines running, and at their maximum capacity, were required for the afternoon demand, while the fourth was in need of repair. Because for several years no accidents to our machinery have occurred, we must not forget that we are continually running greater risks as age and service weaken the machinery and corrosion deteriorates our pipe, while the demands of our population lead us to each year crowd more closely what must be the limit of safety. Plate VII., page 66, shows the effect of temperature and precipitation on the daily consumption, and from this and similar plates for the preceding years the rules for their effects have been deduced.

The work of the draughting room has been continued as formerly, and a vast amount of very valuable information has been added to our records. The territory between Mt. Elliott avenue on the east and Campbell avenue on the west is completely platted by street intersections, and in many cases not only our own work, but all other underground construction is shown. The keeping of the records of construction in the field by a representative of the Engineering Department has been highly satisfactory, and much more reliance can be placed in the records so kept than in those furnished by the former system of foreman's reports.

In closing this report, I wish to express my obligations to the Inspector in charge of the Local Station of the United States Weather Bureau, to the United States Engineers' Office, and to the several city departments for courtesies and valuable information, and to my associates in the service of your honorable body for their hearty assistance and co-operation and friendly advice during the past year.

All of which is, gentlemen, very respectfully submitted.

G. S. WILLIAMS,
Civil Engineer.


EXPLANATION
6" Main.
10" "
12" "
16" "
24" "
30" "
42" "
Pressure Gage.
Contour Line.
150'
140'
130
120'
110'
St. Aubin
Boulevard
Collins
Gratiot
Rohns
sworth
Dubois
Mt Elliott
Boulevard
Baldwin
Vandyke
ld
nd
Chene
Mack
Scott
Gratiot
Wilkins
Cleveland
Kercheval
Elmwood
Concord
Vandyke
Burns
Crane
McLellan
Cadillac
Dubois
Champlain
Congress
Jefferson
Jefferson
Pumping Station
Guoin
E R
BELLE ISLE PARK
Elevation of Mean Water 95 ft City datum

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

Detroit, January 2d, 1896.

To the Board of Water Commissioners:

Gentlemen—In compliance with the rules and regulations of your honorable body, I herewith report the work done in the meter, inspection, service cocks and repairing leaks departments during the year 1895.

The following table shows the number of meters placed during the year and the total number in service on the 31st day of December, 1895:

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
In service Jan. 1, 1895	1,549	677	598	124	142	63	29	4	3,186
Placed during the year 1895	362	110	55	26	24	5	7	......	589
Total number in service Jan. 1, 1896	1,911	787	653	150	166	68	36	4	3,775

The following table shows the total number of meters in service, the different kinds and sizes, and also the number of indicators attached to hydraulic elevators:

In Service January 1, 1896.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thompson	1,845	762	554	134	128	50	20	4	3,497
Crown	34	16	47	11	13	9	4	......	134
Hersey	1	4	36	2	12	2	8	......	65
Worthington	12	4	15	......	12	7	3	......	53
Union Rotary	8	......	1	2	1	1	1	......	14
Neptune	8	......	......	......	1	......	......	......	9
Trident	2	......	......	......	......	......	......	......	2
Buffalo	1	......	......	......	......	......	......	......	1
Aggregate	1,911	786	653	149	167	69	36	4	3,775

Indicators attached to hydraulic elevators 11

Meters in Stock.

KIND.	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Thompson (new)	.....	26	4	13	3	3	.....	49
Crown	2	......	1	1	......	......	......	4
Hersey	1	......	10	1	1	......	......	13
Worthington	1	......	2	......	......	......	......	3
Union Rotary	1	......	6	......	1	......	.....	8
Neptune	17	......	1	......	......	.....	. ....	18
Trident	24	......	......	......	. ...	... ..	......	24
Aggregate	46	26	24	15	5	3	......	119

Valuation of meters in stock January 1st, 1896		$1,575 00
Valuation of material on hand January 1st, 1896		307 19
Valuation of tools January 1st, 1896		478 12
Valuation of horses, wagons, etc., January 1st, 1896		357 50
		$2,717 81

Valuation of meters in service January 1st, 1895		$85,637 03
Deduct 10 per cent. for depreciation in value		8,563 70
		$77,073 33
Add amount expended during the year for meters placed		17,587 85
		$94,661 18
Less stock on hand January 1st, 1896	$2,717 81	
Less amount received for meters sold	371 79	
		3,089 60
Total valuation of meters in service January 1st, 1896		$91,571 58

Cost of material used in repairing meters in 1895	$ 337 33
Cost of labor, repairing meters in 1895	1,495 58
Total cost of repairs	$1,832 91

SUMMARY OF TOTAL AMOUNT EXPENDED IN THE METER DEPARTMENT FOR THE YEARS 1889 TO 1895, INCLUSIVE.

	1889	1890	1891	1892	1893	1894	1895	TOTAL.
Meters..............	$11,175 00	$18,700 00	$6,501 55	$12,371 82	$6,987 43	$8,824 08	$9,235 11	$73,794 99
Supt, and labor.......	1,734 10	8,510 57	4,841 49	8,269 17	8,980 48	6.672 20	6,647 89	45,655 90
Material, tools, etc....	637 26	2,982 14	872 99	2,132 93	1,650 33	1,833 01	1,384 85	11,493 51
Freight, hauling, etc..	98 05	408 97	197 11	244 08	165 12	201 18	71 40	1,385 91
Horse, wagon, etc.....	....	....	....	547 24	184 50	383 07	248 60	1,363 41
Totals..........	$13,644 41	$30,601 68	$12,413 14	$23,565 24	$17,967 86	$17,913 54	$17,587 85	$133,693 72

In presenting this report to your honorable body, I do so fully believing that the money expended in the meter department will prove to have been a wise and profitable investment for the Works.

We have placed 589 meters during the past year, 529 of them at the request of the consumer, showing that the meter is becoming a great favorite with water consumers. The total number now in use is 3,775, and the quantity of water pumped daily, when compared with that of six or seven years ago, will show what they have accomplished in the way of stopping waste. Although the per capita consumption has been reduced from 210 gallons daily to 144, yet it is much too large, and it could be lowered to seventy gallons at least without interfering with any of the legitimate uses. When the weather is not excessively hot or cold, the quantity pumped is not much over 100 gallons per capita, and with all plumbing in proper condition, it ought certainly to be kept at that point during that portion of the year when the heat does not call for a greater consumption.

An apartment house containing twenty-four families, with all modern water fixtures for domestic purposes, consumed an average of thirty-four and one-half gallons per capita daily during the last year. Another, containing six families, with modern fixtures (no washing done in the house, but quite a liberal use of hose), consumed only twenty gallons, showing that the present average consumption throughout the city is still excessive.

The objection is sometimes raised that such a low consumption would tend to produce disease, as the sewers would not be properly flushed, etc., but results in this and other cities that are largely metered does not bear out the claim. For instance, the death rate per 1,000 in this city in 1889 was 17.40 with no meters in use, while in 1895, with about 7 per cent of the service connections metered, it was only 15.80, showing a gradual decrease in the death rate, as well as the quantity of water consumed. In the City of Providence, R. I., in 1893 they had 17,417 service connections and 12,088 meters, which shows that a little over 69 per cent of their service connections were metered. Their death rate per 1,000 for that year was 20.92. In 1894 they had 18,152 service connections and 13,153 meters, making over 72 per cent of their services metered, and a death rate of 18.72, showing a decrease in the death rate and an increase in the percentage of metered services. They are placing about 1,000 meters each year in Providence, and their death rate in 1889 was 19.76 per 1,000, and in 1890 it was 21.77, which was the highest point reached, and then falling gradually to 18.72 in 1894, which was the lowest point reached in several years. They pumped in 1893 sixty-one gallons daily per capita, and in 1894 sixty-two gallons. In the City of Buffalo, with no restrictions, they pump about 300 gallons per capita daily, and have a death rate of about 17.34 per 1,000, while Detroit pumps about 144 gallons, and had a death rate in 1895 of 15.80. The average death rate in thirty-seven of the principal cities in the United States for the year 1894 was 19.22, with less than 10 per cent of the service connections metered. And when compared with Providence with a death rate of 18.72 and 72 per cent of their services metered, it would seem as though the use of meters, although largely reducing the consumption of water, does not affect the health of the community in which they are used. In other words, "stopping the constant running of small streams into the sewers does not create disease."

One source of great waste we have to contend with is the closet when placed where there is danger of freezing. The different appliances, or patent valves, that are being used for the prevention of frost in such cases are failures to a large extent, that is, so far as stopping the continual flow of water is concerned, as they are placed down in a vault and usually in an unhandy place to get at, they very soon get out of order so they will not operate, and allow the flow of water continually.

In order to reduce his water rates (which were $16 per year) the owner requested us to place a meter on a small double house of his containing two families, with no water fixtures excepting sinks in kitchen and closets such as spoken of. The results of two months were somewhat startling to the owner. In November and December the average quantity consumed was 9,172 gallons daily, which would amount to nearly $120 per year. The estimated rates had been paid to January 1st, but from that time he will pay the meter rate, and, unless the closets are repaired, instead of making a saving, he will have to pay very nearly as much in one month as he formerly paid in a year, as such leaks never grow less without being repaired, the tendency being to increase until they get to the full capacity of the service pipe.

We have nearly 49,000 service connections in the city, and should every one of them waste the same quantity, there would have to be pumped into the mains about 450,000,000 gallons daily, which is four times the capacity of the works.

There are many such closets in the city, and on which meters should be placed. We have not forced meters on private houses only in a few cases, where pleading or a threat did not have even a temporary effect, but I should think it wise to place meters on all connections where such closets are attached, whether in private families or not.

The consumption in most of the charitable institutions seems to be excessive. The city pays $1,000 per year for the supply of water to such institutions, and during the past year they have consumed 117,929,250 gallons, a quantity which at the regular rates would amount to over $4,000. There ought to be some restriction on the waste of water in such places. As long as there is paid a fixed sum for them they ought to be limited to a fixed quantity (large enough for all reasonable purposes) and over which they should pay the regular rates. It is hardly among the probabilities that any of them would be obliged to pay anything additional, as there would then be an object in stopping the waste, and that being done, they would easily keep within the prescribed quantity.

The cemeteries also consume an unreasonable amount, for which they pay nothing. It would seem as though—while the water is furnished them without charge—they should show a reasonable disposition to not be wasteful in its use, but when the consumption at Elmwood is 16,806,000 gallons (amounting to $569.20) in one year, and at Mt. Elliott 3,162,750 gallons (amounting to $114.42), it looks as though very little attention was paid to the matter.

The rule allowing the free use of hose for lawn purposes on metered connections (as spoken of in my last yearly report) still continues to cause trouble in drawing the line where the free use shall stop and the charge begin. For instance, we have not considered a strip of grass two or three feet wide between the sidewalk and curb a lawn, and have required such hose connections to be placed on outlet side of meter, and in doing so have caused the consumers to claim that they have been discriminated against. The consumption in such cases (while confined strictly to the *lawn*) would be trifling, but the principal use of hose on such premises is for watering the street, and not only that, the careless use of it adds largely to the waste, as it is often thrown down and the water allowed to run for hours until it forms a rivulet in the gutter and finds its way to the sewer. We allowed a hose connection free on a certain place last summer where they had a large lawn, and also a livery stable, in addition to two residences. We had reason to think the occupant was trying to get the best of us, and therefore kept a watch on the premises, and were not long in finding that he had supplied himself with about seventy-five feet of hose, which he attached to the free hose connection and carried it to his barn, where he used it for washing his carriages, watering horses, etc. He was forced to remove the hose connection to outlet side of meter, and after that he had some hose for sale. We have had several similar cases to contend with, and, as I before stated, it causes much trouble and annoyance in deciding just where to draw the line between a metered and unmetered hose connection.

I should think it advisable on metered premises to have all water pass through meter, even though the meter rates should have to be reduced, or some reduction made in estimated rates, where every water taker would receive a benefit and have every hose assessed.

The expenses of caring for meters increase each year, owing to the steadily increasing number in use. On account of the intense cold during a large portion of last winter, we had many meters frozen, and thereby adding somewhat to the cost of repairs. Where meters were frozen through the carelessness of consumer, and all of those placed at request of same, the cost of repairs was charged to them and collection thereof enforced. With few exceptions the damage is repaired at the cost of two or three hours' labor, no new material being required.

We have formerly estimated the life of a meter to be ten years, but with our present experience think it will be much longer, as we have tested quite a number that have been in service nearly seven years, and in ordinary service they show but little wear. When they have been doing a large amount of work, that is, running up to their full capacity, the gear train shows evidence of wear, and in some instances have been replaced with new, but at a trifling cost, and even though the whole measuring chamber should have to be replaced it would only be at an expense of 20 per cent of the cost of the machine, and when this is done it is to all intents and purposes as good as new.

During the past season we have been obliged to replace some of our wooden meter wells (that were built six years ago) with brick. The wood begins to show evidence of decay, and when they are outside of the line of lot we are obliged to replace them with brick, as the Board of Public Works allows no more wood used for meter wells. We have at the present time 996 meter wells; 816 were built by us and 180 by the consumers; 781 of our wells are of wood and 35 brick. Consumers have 155 wood wells and 25 brick. At the present time, nearly all the wells that are required are built by the owner of the premises on which the meter is placed, so that hereafter our greatest expense in wells will be to repair those already built on premises where we forced the meter.

INSPECTION.

The leak examiners have made 55,834 examinations during the last year, and reported 4,482 leaks, 3,948 of which were repaired within the time given for same and 534 were ordered shut off for failure to make the necessary repairs.

The percentage of leaks to number of examinations made was 8.02, being an increase over the previous year, when they were 7.48. The only way to account for the increase is in the larger number of old service pipes of light and medium weight lead which have been in the ground for years. At the time they were put in, the pressure on the mains was much lower than at the present, and they answered every purpose, but with age and increased pressure they are now giving away rapidly, and it will require the strictest attention on the part of the examiners in order to keep the leakage from this source within the present bounds.

Much waste is wilful and no amount of persuasion or force can stop it. In case the water is shut off for wilfully letting it run to waste, the occupant makes all manner of excuses and promises, and succeeds in having it turned on, to have the very same thing occur again, and it is almost impossible to stop it other than by placing a meter on the premises, a remedy that is always successful.

The examiners, in addition to the foregoing work, are occupied from ten to twelve days each month in reading meters and delivering meter bills.

SERVICE CONNECTIONS.

Fourteen hundred and twenty-seven service connections were made during the past year, consisting of 730 five-eighths-inch, 606 one-inch, 44 two-inch, 19 three-inch, 24 four-inch and 4 six-inch. Sixty-eight were discontinued, making the total number of service connections in use January 1st, 1896, 48,918.

In addition to the above we have inserted 334 five-eighths-inch and 237 one-inch service cocks for the iron pipe department on streets where the old mains had been removed and larger ones put in their places. In such cases we have been obliged to connect all of the old service pipes to the new mains, making a total of 561 service cocks inserted for the department. All of those removed were of the old drive cock pattern and could not be used again, as all service cocks are now tapped in—that is, being inserted with a thread or screw instead of being driven in after the hole had been drilled, as was formerly the custom. There are about 1,100 pounds of the old cocks, which are composed of brass and can be disposed of for whatever such metal is worth.

There were 637 less service connections made last season than the year previous, accounted for by the number of wood logs taken out in that year, on which there were 603 service connections. At the time they were put in the Water Works issued a permit, without charge, to tap the wood pipe, as the plumber made the connection and furnished the service cock himself, but when the wood was replaced with iron it necessitated new service cocks and the labor of inserting them, for which the owner of the premises was obliged to pay, and as a large number of wood logs were removed that year (in fact, the last that were in service) made more than an ordinary number of service cocks inserted.

The following statement will show the receipts and disbursements in the service cocks department during the year 1895:

Receipts for service cocks	$ 5,102 50	
Receipts for plumbers' licenses	559 45	
Receipts for labor and material	301 57	
		$5,963 52
Total expense service cocks department	$10,909 16	
Less labor of inspectors	5,016 00	
		$5,893 16
Balance to credit of service cocks	$	$70 36

INSPECTION OF NEW WORK.

The inspectors have given strict attention to the work in their department during the past year, so much so that they have become a terror to a few of the plumbers who in former years were inclined to cover up some portions of their work before being examined, fearing that it would not pass inspection.

This work has been increased of late, as they are now obliged to shut off all vacant houses, and also let them on when reoccupied, and report to the Assessor of their district the facts for a new assessment. It makes many additional calls for them and necessitates many long drives, especially in the outlying districts. They are also still busy preparing their new record of service connections and locating stop boxes. What was said last year on this subject will bear repeating: "The inspectors have devoted much time to locating and making a record of all stop boxes. They are taking new measurements, as there has been so much changing and subdividing of lots since the beginning of our record that in many instances we find the location not properly recorded, and when the boxes happen to be covered up it takes much valuable time to find them, especially so in case of a bursted pipe. It necessitates the utmost vigilance to keep the boxes exposed to view. Sidewalks being repaired, new ones built, or change of grade in street, alley or lot, the tendency is to pay very little attention to the stop box, and it is usually covered up, as the majority of property owners can see very little use for it until there is an urgent request to shut off the water on account of a bursted pipe, when they have a forcible reminder of its necessity."

There were 18,394 places reported to be shut off for nonpayment last year, besides 3,634 to be shut off for vacancy, which would also show the necessity of keeping the boxes in sight at all times, and as there are about 50,000 of them, it is quite evident that it will require strict attention at all times on the part of the inspectors to see that they are kept in proper condition.

The following table shows the duties performed by the inspectors of new work during the year 1895:

INSPECTION OF NEW WORK.

INSPECTORS.	District.	Examined New Connections.	Examined Extensions & Fixtures.	Let on New Connections.	Notified for Building Tax.	Calls for Non-Payment.	Shut for Non-Payment.	Let on for Vacants Re-occupied.	Shut for Vacancy and Request.	Examined for Assessors.	Meter Bills Delivered.	Totals.
John Hatzenbuhler	1	315	301	234	59	2,011	268	206	312	1,239	937	5,882
Robert Pelham, Jr.	2	165	341	113	73	1,939	89	227	293	670	1,079	4,989
C. K. Skinner	3	116	929	103	94	2,874	81	435	607	751	854	6,844
William Forsyth	4	99	667	60	17	2,758	82	317	502	712	979	6,193
Frank Clark	5	149	452	71	33	3,726	148	563	585	488	1,446	7,661
Michael Hart	6	203	477	182	93	1,727	260	543	428	755	1,029	5,697
John Becker	7	136	237	99	53	1,752	113	538	550	1,156	1,159	5,793
Adoph Jasnowski	8	245	432	226	19	1,607	140	445	357	936	798	5,205
Totals	...	1,428	3,836	1,088	441	18,394	1,181	3,274	3,634	6,707	8,281	48,264

PLUMBERS AND PLUMBING.

One hundred and twenty-five licenses were issued to plumbers last year. Although they are all required to produce a certificate from the Board of Health showing that they have passed a satisfactory examination—before the Board of Plumbing Examiners—as to their qualifications as a plumber, the number receiving licenses is about the same as the previous year, showing that very few had to go out of business on account of not being able to pass an examination.

The most serious complaints that come from the inspectors against plumbers is that of putting water fixtures in old buildings (such as baths, closets, etc.) without taking out a permit for same. We have found on different occasions that such fixtures have been put in houses without any report being made to this office. They are usually discovered by accident and sometimes not until after they have been in several years, when it is almost impossible to locate the plumber who did the work, as the occupant (if he knows) does not care to expose him, as he has been receiving a benefit through the plumber's neglect. When we discover a plumber who has neglected to make such report, he, of course, has some excuse to offer, such as neglect of his bookkeeper to take out permit, or else claim that it was taken out and through some neglect in this office there was no account made of it, at the same time failing to produce the permit, which would look as though he was the only one at fault.

Our rules provide that a failure to perform work in accordance with them shall subject the plumber, in the discretion of the Board, to a temporary or permanent forfeiture of his license, but the penalty has never been enforced; such complaints are usually against the larger firms and they have little fear of their license being revoked. If it were possible to impose a fine of five or ten dollars for the first offense and have the amount collected before granting them another permit, I think it would go far toward bringing about a more rigid compliance with our rules. There are undoubtedly many water fixtures in the city to-day, that have been put in old houses, that are not on the assessment rolls on account of the neglect of plumbers in not taking out permits for doing such work and—if the Board have the authority to do so—I think a reasonable fine applied in such cases would have a beneficial effect. With the exception of the foregoing, the plumbers are giving us very little trouble indeed, as a large majority of them seem to have made an extra effort during the past year to comply with the rules governing them, and were it not for a few careless ones, there would be very little occasion for the censure of any.

TABLE showing the number of taps made, and the different sizes, in each ward during the year 1895; also those discontinued.

NEW CONNECTIONS.	SIZES.	WARDS.																Total inserted.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Iron pipe..........	⅝-inch	12	4	20	8	25	20	16	47	41	63	28	50	56	55	156	129	730
" "	1-inch	57	65	29	48	21	29	13	36	30	29	19	19	55	50	79	27	606
" "	2-inch	6	9	3	2	1	5	2	1	3	2	...	2	...	1	4	3	44
" "	3-inch	2	6	1	1	1	...	2	...	...	...	3	...	1	...	...	2	19
" "	4-inch	5	2	1	2	1	2	1	1	1	2	...	...	4	1	1	...	24
" "	6-inch	2	..	1	1	...	...	...	...	...	...	. .	...	...	..	...	..	4
" "	8-inch	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	....
" "	10-inch	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	....
Aggregate.....	....	84	86	55	62	49	56	34	85	75	96	50	71	116	107	240	161	1,427
DISCONTINUED CONNECTIONS.																		Total discontinued.
Iron pipe..........	⅝-inch	9	9	5	4	10	1	2	1	...	4	1	1	4	2	...	1	54
" "	1-inch	4	...	...	...	...	...	5	...	...	...	1	...	...	...	4	...	14
Aggregate.....	....	13	9	5	4	10	1	7	1	...	4	2	1	4	2	4	1	68

TABLE SHOWING THE NUMBER OF SERVICE CONNECTIONS IN USE JANUARY 1st, 1896.

Size of Connection.	No. in 1894.	Added in 1895.	Discontinued in 1895.	Total January 1, 1896.
⅝ inch	36,321	730	54	36,997
1 "	10,888	606	14	11,480
2 "	137	44	....	181
3 "	115	19	....	134
4 "	90	24	....	114
6 "	5	4	....	9
8 "	2	....	....	2
10 "	1	....	....	1
	47,559	1,427	68	48,918

REPAIRING LEAKS.

Although numerous leaks have been reported during the past year, none of them have been of a very serious nature and all were repaired without difficulty.

The force in this department, under the immediate charge of Foreman Wallace, have performed their work most satisfactorily. It requires much skill at times to repair some of the leaks they come in contact with, and only men that have had much experience in that line of work are able to handle them successfully. Eighty-three leaks were repaired in the main pipes during the year. Twenty-six of them were caused by broken pipes and fifty-seven were leaking joints. Of the broken pipes, twelve were of 4-inch, ten of 6-inch, and four of 8-inch, and of the leaking joints, two were in the 3-inch, fourteen in 4-inch, eighteen 6-inch, three 8-inch, three 10-inch, two 16-inch, six 24-inch, four 30-inch and 5 in the 42-inch pipe. Fifty-five gates of different sizes were found leaking and repaired; 1,379 leaks were found in service pipes, all of which were repaired by owner of premises on which they were located. Three hundred and forty-five complaints of "no water" were investigated; many of them were caused by frost, and many more from various

STATEMENT OF LEAKS, COMPLAINTS, ETC., FOR THE YEAR 1895.

MONTHS.	LEAKS.			Blow-Offs Opened.	COMPLAINTS.				SHUT.			LET ON.			GATES.				Blow-Offs Located.	Boxes Set to Grade.	Pipes Frozen.	Let on—Miscellaneous.	Shut—Miscellaneous.	Service Pipes Disconnected.	Service Cocks Replaced.	Stop-Boxes Located.	Mains Secured.
	In Mains.	In Gates.	In Service Pipes.		No Water.	Bad Water.	Short Supply.	Water Running.	Vacant.	Non-Payment.	For Leak.	Vacant Re-occupied.	Non-Payment.	New.	Opened.	Shut.	Found out of Order.	Located.									
January	4	2	39	98	17	..	..	16	6	2	56	4	11	..	..	1	1	..	..	..	11	..	..	..	..	..	..
February	12	2	101	44	52	1	7	12	9	1	118	17	40	3	34	34	6	..	..	..	66	..	..	..	..	..	..
March	7	7	84	142	60	6	5	5	4	1	85	33	13	2	54	54	3	..	..	..	43	..	..	..	..	..	..
April	10	5	150	13	40	3	4	6	13	3	169	61	105	9	24	24	2	1	..	1	..	..	..	..	..	..	..
May	5	2	127	173	42	2	30	5	10	2	109	29	88	3	36	38	3	..	1	3	..	5	..	..	..	..	..
June	10	4	112	316	28	5	23	4	10	..	67	35	31	3	12	11	..	..	..	..	..	2	4	10	4	2	5
July	3	3	119	309	14	19	10	5	16	11	42	26	198	9	63	63	2	..	..	..	..	1	3	1	2	1	7
August	4	..	186	78	4	14	2	2	9	5	33	56	93	9	51	50	21	3	3	5	..	..	..	..	..	..	..
September	5	8	175	132	26	12	8	6	15	..	55	47	27	9	15	14	2	..	3	1	..	8	2	5	1	8	1
October	9	4	141	230	32	18	8	6	29	12	54	58	158	19	13	13	4	..	..	5	..	13	15	15	..	2	2
November	10	8	72	303	14	2	1	3	46	2	51	39	58	6	43	43	4	..	..	3	2	7	7	9	2	3	..
December	4	10	73	165	16	1	5	10	32	2	63	50	14	6	7	7	..	..	..	1	7	6	19	3	4	2	1
	83	55	1,379	2,003	345	83	108	80	199	41	902	455	886	78	352	352	48	4	7	19	129	42	50	43	13	18	16

Attached to this report are a complete list of tools on hand and an itemized account of material in stock in the Meter, Service Cock and Repairing Leaks Departments on the 31st day of December, 1895.

In closing, I beg to thank your honorable body, and the General Superintendent, for the very considerate treatment extended me on all occasions. Also to the heads of the different departments of the Works I am indebted for many courtesies for which I herewith tender my sincerest thanks.

All of which is respectfully submitted.

T. R. PUTNAM,
Supt. Meters and Inspection.

REPORT OF CHIEF ENGINEER AT PUMPING WORKS.

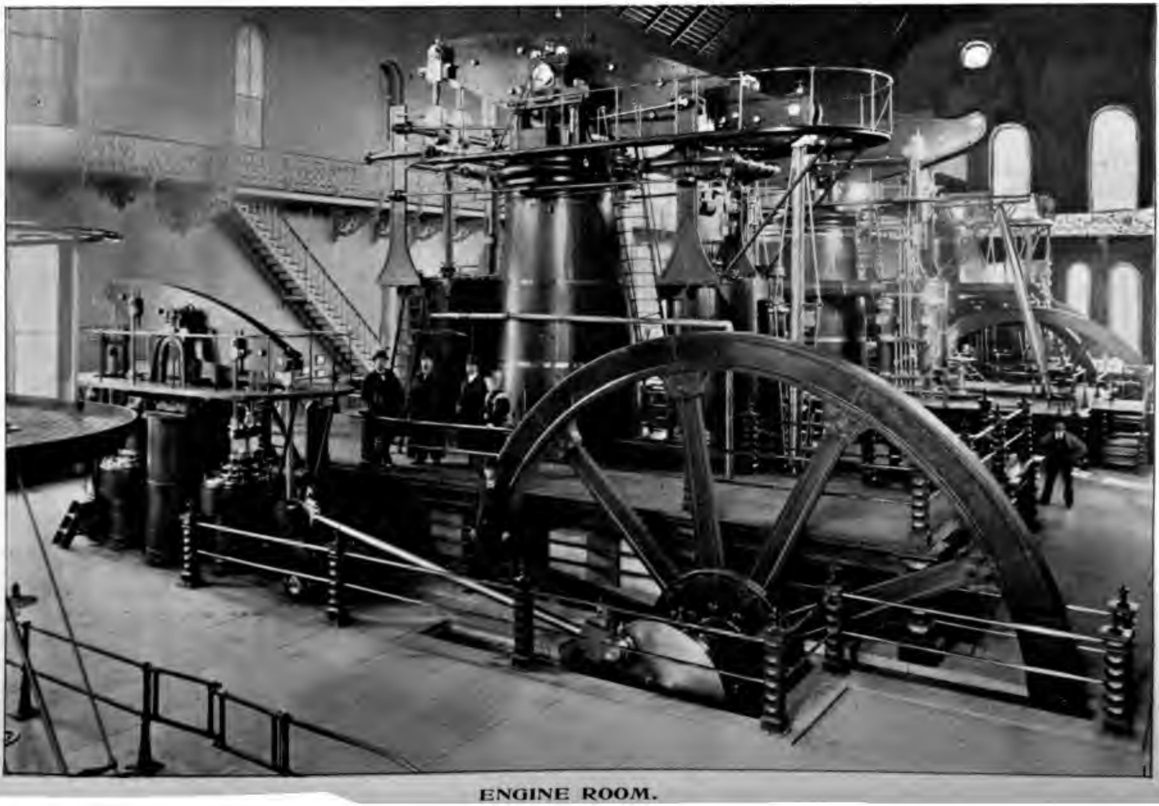
Detroit, January 1, 1896.

To the Board of Water Commissioners:

Gentlemen—I have the honor to submit the **Engineer's** report for the year 1895.

The following table shows the number of gallons of water pumped, and cost of fuel for the years named:

YEAR.	GALLONS OF WATER PUMPED.	COST OF FUEL CONSUMED.	AVERAGE DAILY DELIVERED.
1852	235,840,271	....	646,411
1853	303,531,743	$2,129 37	931,594
1854	376,265,126	2,271 34	1,030,863
1855	542,807,364	3,325 81	1,487,143
1856	692,124,305	4,017 44	1,896,231
1857	697,190,523	3,993 20	1,909,837
1858	718,091,207	3,655 20	1,967,373
1859	782,112,587	3,194 15	2,142,774
1860	870,036,451	4,196 21	2,383,580
1861	895,129,423	4,414 07	2,452,409
1862	994,945,329	3.150 95	2,725,878
1863	1,035,798,043	4,670 86	2,837,803
1864	1,018,390,256	7,647 62	2,839,078
1865	1,049,514,887	7,372 89	2,875,383
1866	1,196,317,922	9,349 16	3,277,583
1867	1,425,535,230	10,121 82	3,905,576
1868	1,666,545,125	11,379 23	4,507,243
1869	1,946,810,325	11,247 92	4,511,809
1870	1,866,060,068	12,713 78	5,112,493
1871	2,300,150,605	14,681 05	6,301,782
1872	2,782,292,578	17,736 86	7,601,892
1873	3,198,393,948	20,233 30	8,762,723
1874	3,289,872,635	20,431 71	9,013,350
1875	4,207,454,260	21,393 98	11,527,272
1876	4,065,134,470	19,832 89	11,107,499
1877	4,213,239,790	17,433 72	11,543,123
1878	4,345,743,330	10,943 82	11,906,146
1879	5,129,599,110	11,219 51	14,053,696
1880	5,552,965,310	12,276 60	15,172,036
1881	6,543,127,968	16,556 63	17,926,377
1882	6,284,000,742	13,156 16	17,261,440
1883	7,379,327,188	16,495 99	20,217,334
1884	8,510,614,140	19,877 07	23,253,044
1885	9,970,829,580	21,341 48	27,317,341
1886	10,576,571,254	20,387 24	28,976,907
1887	13,168,859,808	35,882 83	36,079,166
1888	14,380,166,670	39,568 66	39,397,716
1889	12,875,334,453	34,413 31	35,274,888
1890	12,120,944,532	31,852 40	33,209,067
1891	12,057,261,236	33,826 86	33,033,592
1892	12,476,612,482	31,031 40	34,182,499
1893	13,877,977,208	27,479 93	38,021,855
1894	13,649,779,605	29,283 47	37,396,656
1895	14,698,451,954	32,095 00	40,269,731



ENGINE ROOM.

The following tables show in detail the work done by ch engine each month of the year:

ENGINE No. 1.

ONTHS.	Time run. H.	Time run. M.	Revolutions.	Gallons Water.
nuary	672	....	381,806	585,507,378
bruary	......	....	....	....
rch	96	....	58,683	62,937,930
ril	68	45	100,319	118,509,786
y	586	55	348,365	425,178,570
ne	370	55	233,361	242,450,838
ly	568	....	346,926	396,258,900
ugust	253	05	158,802	185,286,120
September	47	....	29,867	28,725,642
October	480	10	232,824	288,782,790
November	576	....	326,117	366,923,880
December	671	30	392,259	463,813,104
Total	4,340	20	2,609,279	3,164,374,938

ENGINE No. 2.

January	168	....	96,428	155,056,224
February	456	....	306,091	467,600,352
March	480	....	289,128	404,907,864
April	398	20	223,847	274,429,776
May	618	....	361,781	575,577,336
June	337	05	198,062	277,995,072
July	201	05	127,675	165,432,912
August	376	15	220,052	250,198,536
September	559	25	327,123	440,480,160
October	120	15	70,238	108,704,712
November	208	....	124,664	155,585,784
December	192	....	114,735	160,630,128
Total	4,114	25	2,459,819	3,436,598,856

ENGINE No. 3.

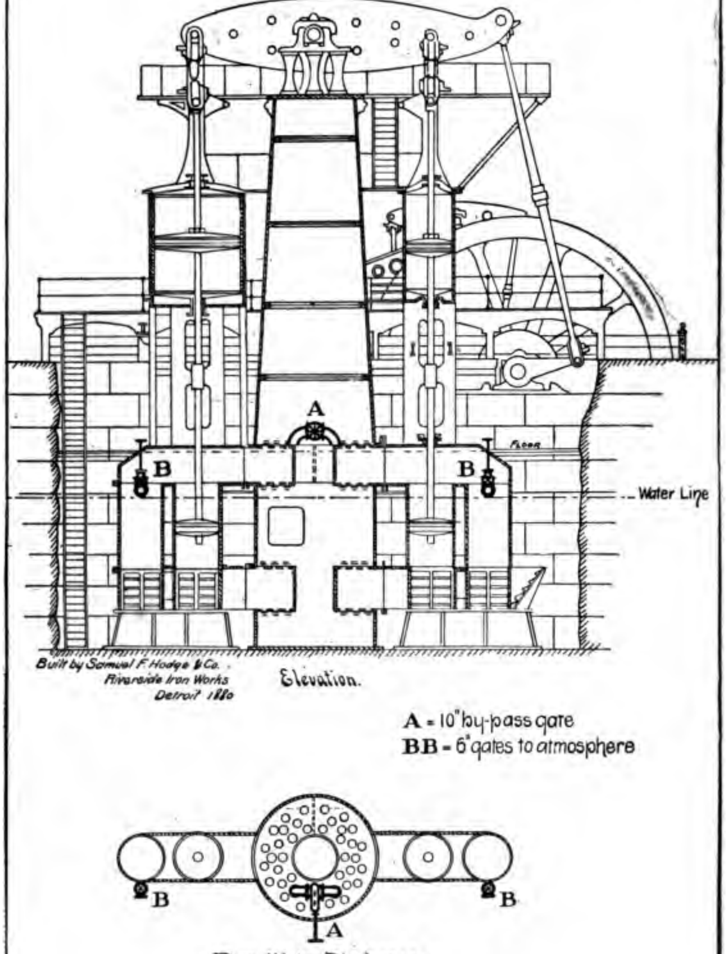
January	......	....	....	....
February	552	....	351,006	631,810,800
March	744	....	434,595	782,271,000
April	720	....	404,750	728,550,000
May	168	....	103,115	185,607,000
June	480	....	296,653	533,975,400
July	526	....	310,920	559,656,000
August	373	30	212,386	382,294,800
September	594	30	352,040	633,672,000
October	672	....	375,207	675,372,600
November	......	....	....	....
December	......	....	....	....
Total	4,830	....	2,840,672	5,113,209,600

ENGINE No. 4.

January	647	35	677,460	531,806,100
February	393	45	424,142	332,951,470
March	168	...	178,060	139,777,100
April	......	....	....	....
May	......	....	....	....
June	346	05	392,390	308,026,150
July	310	15	300,237	235,686,045
August	592	05	559,803	439,445,355
September	144	....	140,691	110,442,435
October	......	....	....	....
November	643	....	556,233	436,642,905
December	624	....	572,600	449,491,000
Total	3,868	45	3,801,616	2,984,268,560
Aggregate	17,153	30	11,711,386	14,698,451,954

Total consumption of oil, 1,929,142 gallons.

Total cost......$32,095.00



Elevation.

Plan of Upper Discharge

24 Million Gallon Pumping Engine
With Device for Reducing Capacity
Detroit Water Works
—1895—

uel oil consumed	$32,095 00
laries—Engineers and firemen	16,625 57
nsulting engineer	1,140 00
al for pumping oil	66 47
Printing and stationery	18 29
Material—Rags, waste, polish, etc	158 61
Material—Valves, gaskets, etc	327 49
Repairs—Boilers and machinery	612 75
Lubricants	484 97
Horse farrier	8 00
Harness and repairs	2 85
Street car tickets	10 00
Expenses on electric light	66 17
Ice	37 04
Commutator	35 00
Boiler inspection	54 50
Demurrage	2 00
Frames	23 00
Freight and telegrams	4 36
	$51,772 07

Cost of fuel per million gallons pumped has been $2.18½, and per million gallons pumped 100 feet high $1.93. Engines Nos. 1 and 2 were run a good part of the year with pumps single acting.

In figuring the cost there has not been any deduction for heating or lighting.

The tables show that the water pumped during the year was 14,698,451,954 gallons. The total expense for pumping water was $51,772.07, making the cost per million gallons, $3.52, which is a good showing considering the increased pressure pumped against and also the increased price of fuel. The average head pumped against has been 116.9 feet, while last year it was only 108.4 feet. In fact, if the price of fuel had remained the same as in 1894, the cost per million gallons pumped 100 feet high would have been only $1.77½, while in 1894 it was $2.06. There has therefore been a gain at the engines of nearly 16 per cent.

In the last report I recommended the shutting off of the stand-pipe, so we would be able to get additional pressure, which was badly needed; it was in the first part of June when the experiment was tried, and it has proved to be more than what we expected, for we are able to run the engines slower than before, when wanted, and we find that one will not interfere with the other as much as before. As we have made some changes in our pumping engines, it will be of no little interest to describe them, as follows:

The changes in the water ends of Engines Nos. 1 and 2 were made so we might be able to work our pumps single or double-acting as the case required, without stopping. By referring to gates marked A B B, on page 92, it will be seen that by opening them, the vacuum in the upper half of both pumps will be destroyed, thereby working the pumps single-acting, the gates B B opening into the air and A being on a by pass between the two pumps. This change has also been supplemented by changing the Stevens cut-off on the high pressure cylinder for the Sickles cut-off, and the effects of these changes on the steam consumption is shown by the indicator cards on page 95, and by the following comparative table for Engine No. 2:

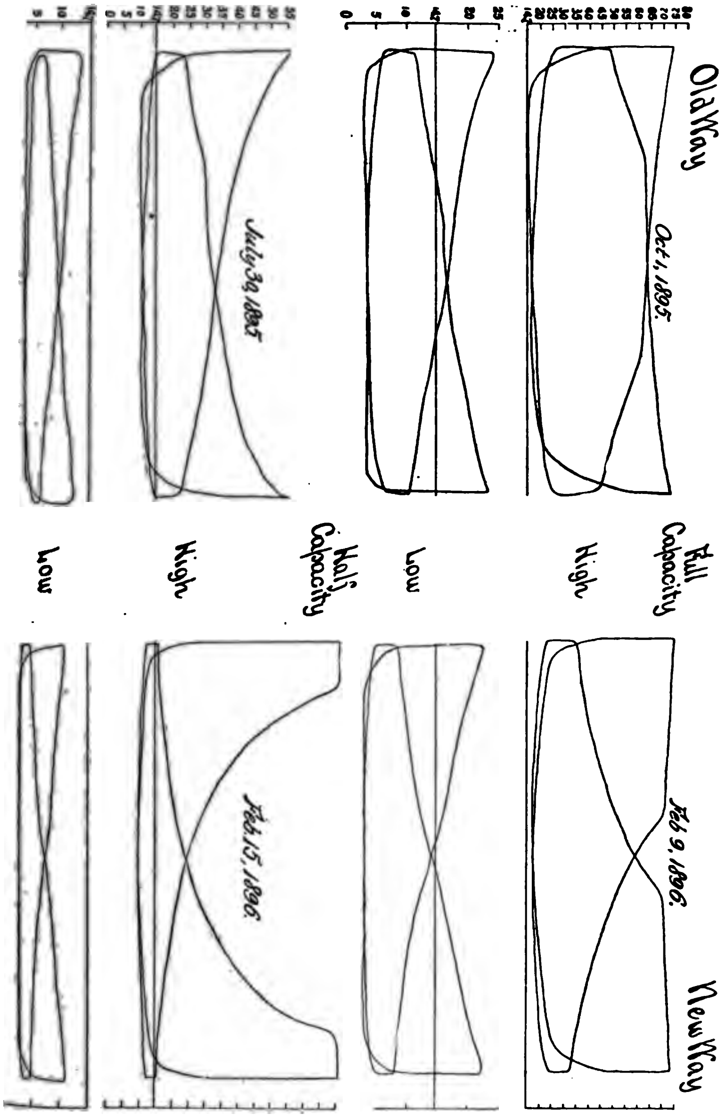
FULL CAPACITY.

	Old Way. October 1, 1895.	*New Way.* February 9, 1896.
Revolutions per minute..	9½	12
Initial pressure..........	60 lbs.	59½ lbs.
M.E P.—	High, 43.2 lbs.; low, 12.4 “	High, 37.0 lbs.; low, 10.8 “
Vacuum................	11½ “	11½ “
I. H. P.—	High, 243.06; low, 235.5..........478.56	High, 262.96; low, 259.09..522.05
Steam per I. H. P	18.09 “	14.88 “
Gain....................		17¾ per cent.

HALF OAPACITY.

	Old Way. July 30, 1895.	*New Way.* February 15, 1896.
Revolutions per minute..	12	10
Initial pressure..........	41 lbs.	56 lbs.
M.E.P.—	High, 22.3 lbs.; low, 5.9 “	High, 20.7 lbs.; low, 4.9 “
Vacuum................	11 “	12 “
I. H. P.—	High, 158.48; low, 141.53.........300.01	High, 122.6; low, 97.93..220.53
Steam per I. H. P.......	17.83 “	14.71 “
Gain....................		17½ per cent

Stroke in all cases 6 feet.



For the case of "full capacity" the only difference in the conditions was that the old way card was taken with the engine running under throttle, which was necessary at times with the Stevens cut-off, and the new way card was taken with the Sickles cut-off, and the throttle wide open.

In the case of "half capacity" in addition to this difference there was a difference in the water ends of the pumps. The old way was to stop the engine, close the inlet gate, pump out the well, take the covers off the suction boxes and the man-hole of one pump, when we would be ready to open the inlet gate and start the engine again, all of which would take considerable time, and when running, one pump would be working double-acting and the other plunger would be working as an idler, churning the water.

All data except the number of revolutions was obtained from the indicator cards.

While these cards, as shown, indicate a gain of 17¾ per cent for the new way running full capacity and 17½ per cent running half capacity, it is not to be expected that when all the conditions are taken into account, which must be constant under both ways of working, and the additional loss from condensation with the greater expansion, these percentages can be maintained.

But the figures certainly show that these engines are more economical of steam under the new arrangement than they were formerly and that our improvements have contributed to the economy of operation in other ways than by reducing the quantity of water pumped; it is to be borne in mind that these cards represent in no sense test conditions and that they may be improved in the near future.

All of the engines are in good condition, but Engine No. 3 is yet to be changed as Nos. 1 and 2 have been. With all engines changed, and our new boilers, which will enable us to carry a higher pressure of steam, we expect the benefit will be considerable.

Engine No. 4, built by the E. P. Allis Co., of Milwaukee, had its final test beginning June 21 and ending the 27th.

The official duty of the engine as reported by Mr. George H. Barrus, of Boston, was 142,366,443 foot pounds per 1,000 pounds dry steam for the six-day run, and for a 30-day run he figured that the coal duty would be 127,000,000 foot pounds; the engine was at the time running at its rated capacity of 24,000,000 gallons and did its work nicely.

The work of this engine under every day conditions is also highly satisfactory. From a comparison of the yearly records for the two years past with those of the last month, when the oil supplied to the engines has been measured separately, the following approximate results have been obtained of the performance of this engine and the remodeled old engines:

Average cost of pumping per million gallons 100 feet high:

With old engines 1895 (corrected for heating, etc.)	$1 93
With Engine No. 4	1 32
Gain with No. 4	31½%
With old engines, 1894 (no correction for heating, etc.)	$2 20
With old engines, 1895 (no correction for heating, etc.)	$2 02
Gain with remodeled engines, about	9%

All figured at cost of fuel for 1895.

The correction for heating and lighting is made because all the steam so used is taken from the boilers supplying the old engines and all the fuel so consumed is therefore charged to them by the uncorrected report of the measured oil burned. The average speed of Engine No. 4 for the period of the above determination of cost was only about three-fourths of contract speed.

The boilers are in fair condition, although but minor repairs have been made on them this year, but the four in the east room will need some slight repairs soon.

The engine house is in the same condition as formerly, but it must be said that the interior is more comfortable since the introduction of the heaters and in appearance it is second to none.

As the Commissioners are contemplating using coal as fuel, the coal sheds and scales will need some repairs.

Respectfully submitted,

URIAH GOULD,

Chief Engineer of Pumping Station.

Office of
Geo. H. Barrus,
95 Milk St., Room 54.

Boston, July 24th, 1895.

Board of Water Commissioners, City of Detroit, Mich., and The Edward P. Allis Co., Milwaukee, Wis.:

Gentlemen—In accordance with your joint request I conducted a six-days' continuous duty trial of the 24,000,000 gallon pumping engine recently erected by The Edward P. Allis Company at the Detroit Water Works, beginning at 10 p. m., June 21st, 1895, and ending at 10 p. m., June 27th, 1895, and I beg to submit the principal results of the same as follows:

Duty based on 1,000 lbs. of dry steam..........ft. lbs.	142,366,443
Number of gallons of water pumped in 24 hours..	24,345,721

I have estimated from these results the corresponding duty based on 100 lbs. of best anthracite coal, as stipulated in the contract, assuming a fair degree of boiler efficiency when using such coal, and I make the duty for a 24-hour test 134,104,023 ft. lbs., and for a 30-day test 127,398,822 ft. lbs., both of which are in excess of the quantities guaranteed by the builders.

A detailed report of the trial is presented in the accompanying pages. I am,

Faithfully yours,

(Signed) GEO. H. BARRUS.

Copy.

ABSTRACT OF REPORT.

NATURE OF GUARANTEE.

In the contract made between the City of Detroit and the Edward P. Allis Company for this engine, the requirements in the matter of capacity were to the effect that the engine should pump 24,000,000 gallons of water in 24 hours, against a head varying from 116 feet to 135 feet, with a piston speed of 215 feet per minute, or 21½ revolutions per minute. The duty requirements were that on a 24-hour test the engine should give a duty of 130,000,000 foot-pounds for 100 pounds of best anthracite coal, and on a 30 days' continuous test, with steam at 125 pounds pressure and a head of 120 feet, it should give a duty of 120,000,000 foot-pounds.

Considering that the fuel used at the present time, and likely to be used in the future, is fuel oil and not anthracite coal, it seemed inexpedient to make the duty trial under the conditions strictly imposed by the contract. It was therefore mutually agreed between the Water Commissioners and the builders that the test should be made under the present working conditions of the plant, and that its duration be limited to six days, the principal object in view being the determination of the general performance of the engine in the matter of economy and capacity. From the results thus obtained it was decided to estimate the duty realized under the specific terms required by the contract.

DESCRIPTION OF PLANT.

The plant as a whole embraces the engine, which is of the vertical triple-expansion flywheel type, and a battery of four horizontal return-tubular boilers. With the exception of the oil-burning apparatus, the plant was furnished complete by the Edward P. Allis Company. It is operated independently of the remaining machinery at the water-works, although the water is discharged into the common system. The boilers are operated with oil obtained from the Ohio fields, the so-called Reed burner being employed.

The supply of water for the engine is drawn from a pump well in the yard some 20 feet distant from the engine-house, and it discharges into the same force main which carries the water from the other engines to the city service. The system here used is that of direct pumping, and the speed of the pumps requires to be varied according to the demand. Moreover, it is necessary, owing to the arrangement of the mains and the exigencies of the service, to maintain a higher pressure during the day runs when the demand is at a maximum, than during the night runs when the demand is reduced. The changes of speed which are necessitated by these conditions are made by the attendants of the pumping station, who are constantly on watch for this purpose. In conducting the duty trial, it was necessary to conform to these circumstances, and consequently the conditions as to water pressure, regularity of speed, and other details of the work which bear upon them, could not be maintained throughout the trial at fixed points.

The engine is similar in general features to the Allis engine at the Milwaukee Water Works, which is fully described on p. 321, Vol. XV., of the Transactions of the American Society of Mechanical Engineers.

The boilers are of the usual form of the horizontal return-tubular type, fitted with steam domes. The brick setting differs from the ordinary arrangement owing to the provisions for oil burning. The grates are covered with brick tiling and sand, which is laid over the whole surface with the exception of a strip at the front 4 inches in width. Beneath the grate the space is divided by means of additional tiling placed nearly horizontally, and the air for combustion is made to pass first to the rear end of the ashpit and then forward above the tiling and beneath the grate before entering the 4-inch opening at the front end. By this arrangement the air is somewhat heated before its supply to the furnace, and its quantity is reduced so as to prevent unnecessary excess. At the rear end of the boiler is a hanging bridge wall, and the products of combustion are forced to take a detour beneath it before entering the tubes at the rear end. One burner is provided for each boiler. The burner consists essentially of an injector operated by steam, the oil being supplied to the outside of the steam jet. Both the oil and the steam are regulated by valves. For the purposes of the test the supply of steam for the burners was taken from the other boilers of the pumping station. The steam pressure is regulated by adjusting the burners. During the trial it was maintained at practically a constant point.

THE DUTY TRIAL.

The duty trial embraced a complete performance test of the plant, all of the required data for such a test being obtained excepting the quantity of water actually discharged by the pumps. With the system of distribution here in use it was inexpedient, if not impossible, to measure the water actually pumped, except by reference to plunger displacement, and this was the method adopted. The amount of slip in pumps of this design is extremely small (probably not over 1 per cent), and the quantity computed from plunger displacement may be relied upon for all practical purposes as the actual amount delivered.

In general, the methods followed were in accordance with the recommendations of the Duty Trial Committee of the

A. S. M. E. A preliminary test was run under the working conditions of the plant, and during this test, which lasted six hours, the working temperature of the feed water was determined. On the conclusion of this run the jacket water was turned to waste, and the main duty trial was started. All steam and water connections not concerned in the work of the test were first blanked off. The formal trial commenced at 10 p. m. June 21, and continued without interruption and without stopping the engine until 10 p. m., June 27, or exactly 144 hours. Leakage of water and steam into the two boilers not in use, and leakage of the blow-off cocks, was collected from the main blow-off pipe, and its quantity deducted from the feed water as measured. Other accidental leakages which occurred were measured or estimated, and properly allowed for.

During the progress of the trial the quantity of feed water was determined for the whole period of six days. Observations of the principal instruments, embracing steam gauge, water gauge, revolution counter, and readings referring to them, together with some of the other instruments, were made every 15 minutes during the whole trial. The quantity of oil consumed was determined by weight for the first three days, and by meter for the last three days. The quantity of jacket water was determined by weight for the last three days of the test. The calorimeter showing the quality of the steam was operated for a period of two hours once in every eight hours during the whole run. Indicator diagrams were taken from the steam cylinders every hour. Diagrams were also taken from the high pressure pump cylinder nearly every hour during the day runs, and at the same time from either one or the other of the two remaining pump cylinders. Observations of the remaining instruments were made at intervals of half an hour, and, in some cases, one hour, during the trial.

Further particulars as to the instrument and apparatus used, their location, and the method of obtaining data, are given in the full report.

Results.—The principal data and results of the trial are given in the following tables, the first of which relates to the duty and capacity for the whole six days' run. Table No. 2 refers to the work of the steam cylinders and gives the principal measurements and results obtained from the indicator diagrams. Table No. 3 relates to the friction of the engine and the consumption of steam by the jackets. Table No. 4 gives the data and evaporative results obtained from the boilers.

Following the tables are copies of representative diagrams and a combined diagram, as already noted, together with a chart giving the number of revolutions for each hour during the whole trial, and the pressure in the force main.

The estimate of duty given by 100 pounds of best anthracite coal on a 24-hour test is based on the assumption that such coal has a calorific value of 13,787 British thermal units per pound of coal, and that the boilers on such a test give an efficiency of 75 per cent, or in other words, that they utilize 10,341 heat units per pound of coal, which corresponds to an evaporation of 10.71 pounds of water from and at 212 degrees. The calorific value of best anthracite coal here given is the mean of two of the best results which the writer has obtained from such coal by the use of his coal calorimeter. The efficiency given is not the best that can be obtained from anthracite coal, but it seems to be a fair percentage to be used for the purpose in view. It is not uncommon for boilers of this class to attain an efficiency of 80 per cent.

The estimate of duty given by 100 pounds of coal for a 30 days' test is based on the assumption that the duty would fall 5 per cent below that realized on a 24-hour test. This difference is ample to cover all the necessary losses due to cleaning fires, blowing off, and other exigencies of a prolonged working trial.

The results obtained on this trial will naturally be compared with those of the celebrated Milwaukee test on an engine which, in respect to the steam cylinders, is almost an exact duplicate. The engine at Milwaukee gave a duty based on 1,000 pounds of feed water of 152,448,000 foot-pounds, and the consumption of dry steam per indicated horse-power per hour was 11.678 pounds. The economy realized on the Detroit engine falls some 7 per cent below that indicated by these figures. A comparison of the records of the two tests shows unmistakably the principal reasons for this difference. The most important of these is the difference in the vacuum in the condenser on the two trials. That at Milwaukee was 13.8 pounds, the temperature of the injection water being 34 degrees, while that at Detroit was 12.4 pounds, or 1.4 pounds less, the temperature of the water here being 71 degrees. The reduced vacuum counts heavily against the work done by the low-pressure cylinder, being in this case nearly 20 per cent of the mean effective pressure shown by the low-pressure diagrams, and about 7 per cent of the total mean pressure referred to the low-pressure cylinder. In the Detroit engine, owing to less water pressure, the pumps were of larger diameter than those at Milwaukee, and consequently the friction of the engine was increased. According to the records the friction of the Milwaukee engine was 9.2 per cent, while that of the Detroit engine was 10.2 per cent. Furthermore, the Milwaukee engine delivered the water into a reservoir, and the work of the engine was performed under nearly constant conditions of water pressure and speed. In the case of the Detroit engine the head varied from 115 feet to 136 feet, while the engine was proportioned to give the best economy at 120 feet head. This, so far as it acted, was unfavorable to the engine.

It is probable that if the Detroit test had been made in the winter, as was that at Milwaukee, so as to secure the advantage of cold injection water, the vacuum in the condenser would have been equal to that obtained at Milwaukee, and the duty would have been correspondingly increased.

TABLE NO. 1—MAIN DUTY TRIAL.

JUNE 21 TO JUNE 27, 1895.

	DIMENSIONS.	
1.	Number of water plungers........................	3
2.	Diameter of each plunger.....................ins.	36
3.	Stroke of each plunger........................ft.	5
4.	Area of each plunger......................sq. ins.	1,010.87
	TEMPERATURES.	
5.	Temperature of water in pump well..........degs.	71.3
6.	Temperature of feed water supplied to boilers, degs.	124.3
	FEED WATER.	
7.	Total weight of feed water supplied to boilers, lbs.	1,058,879
	PRESSURES.	
8.	Boiler pressure by steam pipe gauge...........lbs.	125.2
9.	Total head expressed in feet....................ft.	123.5
10.	Total head expressed in pounds...............lbs.	53.438
	MISCELLANEOUS DATA.	
11.	Duration of trial.............................hrs.	144
12.	Total number of revolutions during trial..........	184,172
13.	Percentage of moisture in the steam......per cent.	0.32

DUTY AND CAPACITY.

14.	Duty based on 1,000 pounds of feed water	ft. lbs.	141,910,871
15.	Duty based on 1,000 pounds of dry steam	"	142,366,443
16.	Duty based on 1,000,000 heat units	"	129,681,871
17.	Estimated duty based on 100 pounds best anthracite coal for a 24-hour test	ft. lbs.	134,104,023
18.	Estimated duty based on 100 pounds best anthracite coal for a 30 days' test	ft. lbs.	127,398,822
19.	Capacity or number of gallons of water discharged in 24 hours	gals.	24,345,721

TABLE NO. 2.—DATA AND RESULTS PERTAINING TO STEAM CYLINDERS.

JUNE 21 TO JUNE 24, 1895.

DIMENSIONS.

1.	Diameter of high-pressure cylinder	ins.	28
2.	Diameter of intermediate cylinder	ins.	48
3.	Diameter of low-pressure cylinder	ins.	74
4.	Diameter of piston-rods, two for each cylinder	ins.	4
5.	Length of the stroke	feet	5
6.	Clearance of high-pressure cylinder	per cent.	1.4
7.	Clearance of intermediate cylinder	per cent.	1.5
8.	Clearance of low-pressure cylinder	per cent.	0.8
9.	Ratio of volumes		1, 2.978, 7.108

DATA AND RESULTS.

10.	Duration	hrs.	72
11.	Total weight of feed water consumed	lbs.	518,811
12.	Weight of feed water consumed per hour	lbs.	7,205.7
13.	Dry steam consumed per hour	lbs.	7,182.7
14.	Indicated horse-power developed by high-pressure cylinder	H. P.	191.3
15.	Indicated horse-power developed by intermediate cylinder	H. P.	176.04
16.	Indicated horse-power developed by low-pressure cylinder	H. P.	206.39
17.	Indicated horse-power developed by whole engine,	H. P.	573.73
18.	Average steam-pipe pressure	lbs.	125.6
19.	Average pressure in first receiver	lbs.	30.3
20.	Average pressure in second receiver	lbs.	0.8
21.	Average vacuum in condenser	lbs.	12.4
22.	Atmospheric pressure by barometer	lbs.	14.7
23.	Average revolutions per minute		20.99
24.	Mean effective pressure, high-pressure cylinder,	lbs.	49.85
25.	Mean effective pressure, intermediate cylinder,	lbs.	15.4
26.	Mean effective pressure, low-pressure cylinder,	lbs.	7.57
27.	Dry steam consumed per indicated horse-power per hour	lbs.	12.519
28.	Dry steam consumed per indicated horse-power per hour by jackets	lbs.	1.59
29.	Dry steam consumed per indicated horse-power per hour, exclusive of steam used by the jackets	lbs.	10.929
30.	British thermal units consumed per indicated horse-power per hour		13.699
31.	British thermal units consumed per indicated horse-power per minute		228.3

MEASUREMENTS AND COMPUTATIONS BASED ON SIX SETS OF SAMPLE DIAGRAMS.

	H. P. Cyl.	Int. Cyl.	L. P. Cyl.
32. **Pressures** in steam pipe and receiver, lbs	125.7	30.1	0.98
33. **Initial** pressure above atmosphere. . lbs.	124.29	30.41	0.20
34. **Cut-off** pressure above zero . . . . lbs.	134.1	38.29	11.54
35. **Release** pressure above zero. . . . . lbs.	44.73	14.33	5.82
36. **Compression** pressure above zero. . . . lbs.	46.8	15.76	2.95
37. **Mean** effective pressure	50.07	15.41	7.59
38. **Back** pressure at mid-stroke above or below atmosphere . . . . lbs.	+29.44	-0.019	-11.86
39. **Proportion** of forward stroke completed at cut-off	.338	.362	.479
40. **Proportion** of forward stroke completed at release	.996	.998	.969
41. **Proportion** of backward stroke uncompleted at compression.	.012	.009	.013
42. **Steam** accounted for at cut-offs. . . . . lbs	9.484	9.53	9.45
43. **Steam** accounted for at release. . . . . . lbs.	9.96	9.97	9.91
44. **Proportion** of steam consumed exclusive of jacket steam, accounted for at cut-off	.868	.872	.865
45. **Proportion** of steam consumed exclusive of jacket steam, accounted for at release	.911	.912	.907

TABLE NO. 3.—MISCELLANEOUS RESULTS.

FRICTION.

1. **Indicated** horse-power developed by steam cylinders during the first three days. . . . . H. P.	573.73
2. **Horse-power** computed from pressure shown by gauges on force main and suction main during the first three days . . . . H. P.	515.41
3. **Power** absorbed by friction of engine. . . . . H. P.	58.32
4. **Percentage** of friction. . . . . per cent.	10.2
5. **Mean** effective pressure measured from pump diagrams . . . . lbs.	57.05
6. **Corresponding** head shown by gauges on force main and suction main expressed in pounds. . . . . lbs.	55.51
7. **Loss** of head between pump cylinders and mains expressed in pounds. . . . . lbs.	1.54
8. **Percentage** of friction between pump cylinders and mains referred to power developed in the steam cylinders . . . . per cent.	2.5

JACKET STEAM.

9. **Total** weight of water supplied to boilers during last three days uncorrected for moisture in steam. . lbs.	540,068
10. **Total** weight of water drained from jackets during last three days . . . . lbs.	68,755
11. **Percentage** of total steam condensed in jackets, per cent.	12.7
12. **Weight** of steam condensed in jackets per hour, lbs.	954.9
13. **Average** steam pressure in low-pressure jacket last three days . . . . lbs.	45.8
14. **Average** steam pressure in low-pressure jacket for whole trial . . . . lbs.	46.1

15. Weight of steam condensed per hour in jackets with engine at rest	lbs.	163.5

TABLE NO. 4.—DATA AND RESULTS OF BOILER TEST WITH FUEL OIL, FIRST THREE DAYS.

DIMENSIONS.

1. Number of boilers		2
2. Diameter of each shell	ins.	62
3. Length of each shell between heads and length of tubes	ft.	20
4. Number of tubes 4 ins. in diameter, each boiler		49
5. Area of heating surface, two boilers	sq. ft.	2,304

TOTAL QUANTITIES.

6. Duration	hrs.	72
7. Weight of fuel oil consumed		40,164
8. Number of gallons of oil consumed	gals.	*5,656.9

*No deduction made for moisture. It is assumed that the steam leaving the boilers was dry.

9. Cost of oil at 1.56 cents per gallon		$88.24
10. Weight of water evaporated (including steam used by calorimeter)	lbs.	519,581

HOURLY QUANTITIES.

11. Weight of oil consumed per hour	lbs.	557.8
12. Water evaporated per hour	lbs.	7,216.5
13. Equivalent evaporation per hour, feed 100 degrees, pressure 70 pounds	lbs.	7,382.5
14. Horse-power developed, A. S. M. E. basis of 30 pounds	H. P.	246.1
15. Equivalent evaporation per square foot of heating surface per hour	lbs.	3.2

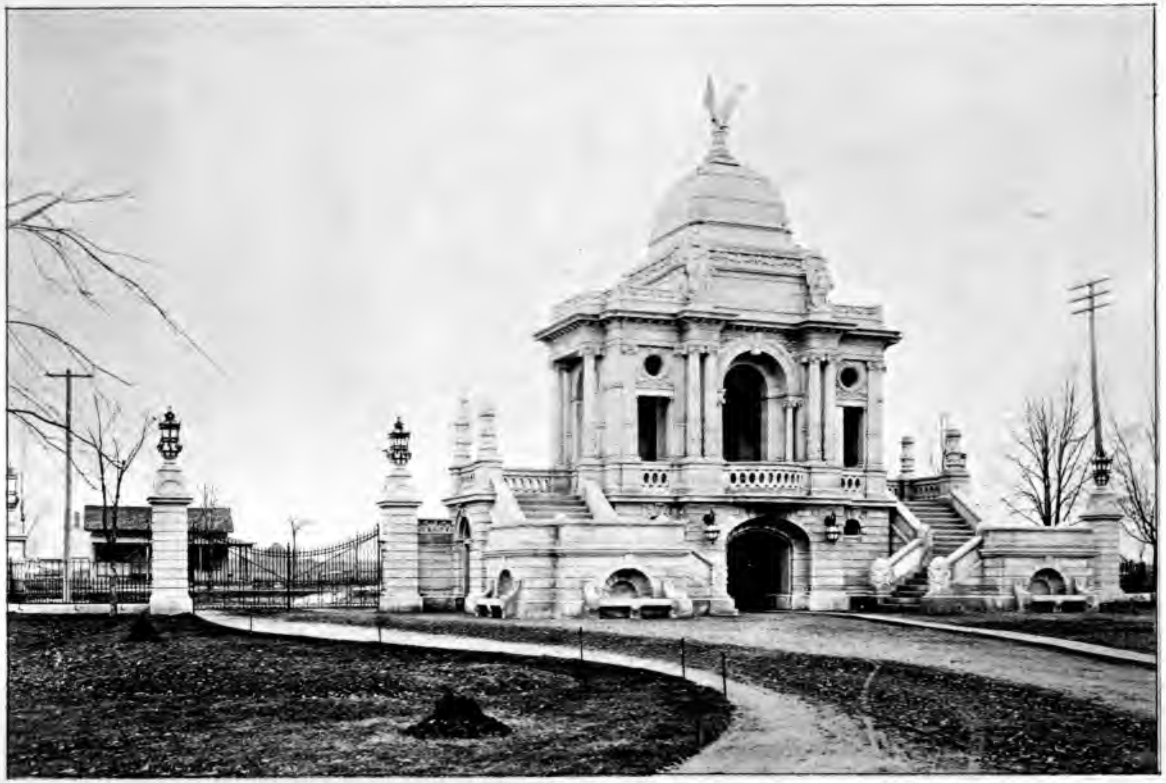
AVERAGES OF OBSERVATIONS, ETC.

16. Average boiler pressure	lbs.	126.2
17. Average temperature of feed water	degs.	85.3
18. Average temperature of flue gases	degs.	479.4
19. Average draft suction	in.	.37
20. Percentage of moisture in steam at engine	per cent.	0.32
21. Weather and outside temperature		Fair, warm.
22. Calorific value of oil per pound by chemical analysis	B. T. U.	21,209

RESULTS.

23. Water evaporated per pound of oil from actual temperature and pressure	lbs.	12.934
24. Water evaporated per pound of oil from temperature of 121 degrees	lbs.	13.396
25. Equivalent evaporation per pound of oil from and at 212 degrees	lbs.	15.218
26. Efficiency	per cent.	69.3

Note.—No allowance is here made for steam used by the burners which was supplied by the other boilers. As elsewhere noted, it was found to be 4½ per cent. of the quantity used by the engine. The cost of oil corrected for this amount becomes 92.22, and the evaporation per pound of oil from a temperature of 124.3 degrees, 12.82 pounds.



THE HURLBUT MEMORIAL GATEWAY

REPORT OF THE SUPERINTENDENT OF GROUNDS.

To the Honorable Board of Water Commissioners:

Gentlemen—In the philosophy of life, the having done our full duty to-day, ought to bring contentment. But will it?

In these later days, the most energetic men in the fields of art and science strive to reach the very top notch of their ambition, and then are not entirely satisfied, and find satisfaction only in the thought that Rome was not built in a day.

Detroit, beautiful as she is, with her broad avenues, beautiful parks and boulevards, magnificent buildings, endowed by nature with beautiful surroundings, is not yet finished, but is only just begun. Thousands of years hence, when the work is far advanced, perhaps those in charge will then think as we do to-day, there yet remains much to do.

Considering the short time since the improvements of the Water Works Park began, I think we should be well pleased with the progress made.

The thousands of visitors from other parts of the country join with our own citizens in expressing themselves as delighted with the Park.

The improvements now under way, and which are likely to be completed before next season is far advanced, will, in my opinion, add more to the beauty of the Park than any former improvement. Taking down the basin fence and filling in an earth embankment between the basin and canal, in place of the old dock, will have telling effect.

The planting of large trees in the southerly part of the

Park will afford much needed shade, and besides give age and finish to what was a short time ago only marsh land.

The cutting off the piling and lowering all timber below the water, and covering about seven feet of the slope on the west canal bank with cobble stones nicely laid, is an improvement worthy of mention, providing Uncle Sam can be persuaded to stop the drainage of the Great Lakes, which is continually lowering the water level.

Another improvement which will be very much appreciated is the toilet room for ladies.

The improvements now most needed, which I hope your honorable body will soon order, are one team and two foot bridges across the winding canal. Also a good greenhouse, as the houses we now have are propagating houses, and we use every foot of them for growing the class of plants known as bedding plants.

If we had a properly constructed greenhouse that would be ornamental as well as useful, we could have on hand a class of plants we now have no room for, such as palms and other tropical plants; also roses, carnations, etc., which would be an attraction all the year through.

I am glad to say the proper earnings of the Hurlbut estate will likely be sufficient to pay the ordinary expenses of the Park, so that whatever pleasure and satisfaction the people get from the Park will be absolutely free of cost to them. In conclusion would say our stock of bedding plants is in fine condition and we hope to make a floral display next season that will be satisfactory.

I enclose an inventory of the movable property on hand in this department of the value of $1,400.05.

Very respectfully,

E. A. SCRIBNER,
Supt. Grounds.

REPORT OF THE SUPERINTENDENT OF EXTENSIONS.

Detroit, Michigan, January 2, 1896.

To the Board of Water Commissioners:

Gentlemen—In accordance with the regulations of the Board of Water Commissioners, I have the honor of presenting to you my annual report, relative to the general condition and progress of the work in this department.

It will be seen by the records of this office that the extensions of the year just closed were less about 16 miles than for the previous year, but if we take into consideration the fact that 2¾ miles of 42-inch main have been laid the past year, the magnitude of this work as compared with smaller lines with the extra labor necessary thereto, greatly compensates for the shortage in mileage.

The extensions of the past year for the replacing of smaller lines of pipe with pipe of larger size, have been about 4 miles only, or about one-third of the length for the year previous, and were largely recommendations of that year, but which were not completed until the past season.

At the close of the year 1894, quite an extensive call was made upon your honorable body by the Park and Boulevard Commissioners, for an extension of distribution pipes along the boulevards; the call covered a distance of about $3\frac{8}{10}$ miles. The desire of the said Board was, that a system of pipeage might be laid to which hydrants could be attached, and set about 600 feet apart, for the sprinkling of the lawns and driveways. There being no water-takers along these proposed lines to be laid, it became necessary, in accordance with the regulations of your honorable body, to impose a bonus, which should cover a certain per cent of the cost as an inducement to lay the lines of pipe as called for. To meet this an agreement was had, that all common labor necessary for the excavating and back-filling of the pipe trenches should be furnished by that body, the supervision and pipe-laying, including all pipe and materials for the laying of these lines should be met by your honorable body. This agreement being satisfactory, the work was commenced the early part of January of the year just closed. In meeting this call, provision was made by the Engineering Department as to size and location of the same for future use.

In addition to the above, 2,844 feet of 4-inch pipe was laid for the said Park Board for the connecting of their hydrants along the entire boulevards, the total cost of which was met by the same.

NEW LINE OF 42-INCH FORCE MAIN.

The past year has witnessed the completion of this third line of 42-inch main. This makes the third main of this size conveying the supply of water to the city from the pumping works, making a combined area of 72¾ inches in diameter or a daily capacity of 75,000,000 U. S. gallons. This would seem a sufficiency for some time to come.

Work on the above mentioned main was commenced about the middle of April, working from inside of the grounds of the pumping works and running westerly along Jefferson avenue to Crane avenue, up to which point the line was completed, and from this point the gangs were taken to the westerly end of the line at Champlain and Chene streets, commencing operations working easterly to Crane avenue.

This line was as vigorously prosecuted as opportunity would permit. The section of the line from inside of the pumping works grounds and along Jefferson to Crane avenues, and from this point through private property to Iroquois avenue, a distance of 3,750 feet; the trench was excavated to an average depth of 14 feet. The reason for this excessive depth was to allow this section of the line to underneath the lower or No. 1 42-inch force main and give sufficient clearance for basement excavations, should be required to build over where this section of the said main lays.

This line was connected to the 30-inch main in Chene street, at which point a section of the 30-inch main was cut out, and a 42x42-inch Y branch, with 42x30 inch reducers, and a 30-inch gate was inserted; thence from this branch, making an easy radius crossing Champlain street from north to south, the lines then run easterly along the south side of the roadway. From this point to Baldwin avenue the street is paved and on which the Fort Wayne Belle Isle Company car tracks are laid; coupled with this the contracted width of the street, which is not over 50 feet in width, made quite a formidable obstacle in our way while at work on this line, the traffic of the road being kept open. This section equals about 55 per cent of the entire length, and had it not been for the kind courtesy of the said company and their superintendent of construction, Mr. Hazard, allowing us the use of the south car track, between Elmwood and Baldwin avenues, between which points a double track is laid, it would have been an utter impossibility to have prosecuted the work without a greatly added expense. Notwithstanding this additional space, rendered us by the use of this track, we found our hands full in pushing the work in an expeditious manner. I think I may be at liberty to say right here that it is only just to Mr. August Meike and his corps of assistants having charge of this work to say that in all of the handling of this heavy work not a single accident occurred worthy of mention. To this line branches were set for cross street connections and to which every street having distribution pipe in have been connected, three of the branches have an outlet of 24 inches diameter; these branches are to connect with the lower No. 1 42-inch force main that are set at Mt. Elliott, Bellevue and Crane avenues; the one at Crane avenue being connected, the other two will be at some future date.

To this line and along its entire length, including the pumping works grounds, 13 42-inch water gates are set. One of these is a Murdock and 12 the Michigan Brass & Iron Works make.

The apportionment of the length of this line and its location through which it is laid is as follows:

In pumping works grounds, including all connections, 865 feet, or 6 per cent of total length.

Jefferson avenue, from 266 feet west of Cadillac to Crane avenue, 2,109 feet, or 15 per cent of total length, unpaved section.

In line of Champlain street, through private property from Crane to Iroquois avenue, 1,135 feet, or 8 per cent of total length.

Champlain street, from Iroquois to Baldwin avenue, 2,315 feet, or 16 per cent of total length, unpaved section.

Champlain street, from Baldwin avenue to Chene street, 7,879 feet, or 55 per cent of total length; this last section is paved and upon which the tracks of the Fort Wayne & Belle Isle Company are laid.

The principal lines laid in addition to the above 42-inch mentioned were as follows:

Fort street, from Seventh to Tenth street, 12-inch replacing 6-inch pipe; to this a new line of 8-inch in Eighth street and Trumbull avenue were connected; also the 8-inch line in Tenth street. A 12-inch line was laid in Porter street, from the 24-inch main in Tenth street to Fourteenth avenue, and from this point a line of 10-inch was laid to Twentieth street, and still westward in said street an 8-inch line of pipe was laid to Twenty-second street, several short lines of 3 and 4-inch pipe were replaced by the laying of the above.

A 10- and 12-inch line of pipe were laid in Burns avenue, the 10-inch being laid from the lower 42-inch main in Jefferson avenue to the new line of 42-inch main in line of Champlain street, the 12-inch from the new 42-inch main to St.

Paul avenue; this line connects the two 42-inch mains at this point.

A 10-inch line of pipe was also laid in St. Aubin avenue from North Boulevard to Clay avenue, this line connects with the 24-inch in said Boulevard.

Frontenac Boulevard, a line of 10-inch was laid on the east side from Mack to Gratiot avenue, and in Hendrie Boulevard, a line of 8- and 10-inch was laid from Collins street 30-inch main to the Frontenac Boulevard, the 10-inch being between Collins street and Mt. Elliott avenue and the 8-inch from this point to Frontenac Boulevard; to the above, all streets crossing the same where pipe had been previously laid were connected.

An 8-inch pipe was also laid in Alfred street from Woodward avenue to John R. street, replacing a 4-inch line. The same size pipe was also laid in Eighth street from River street to Michigan avenue, several short sections of 4-inch were replaced by this. A line of 8- and 6-inch was also laid in Iroquois avenue from the new 42-inch main in Champlain street to St. Paul avenue. The same size was also laid in Joseph Campau avenue, from Catherine to Jay streets; also in Kercheval avenue from Mt. Elliott to Beaufait avenues, this replaced a 4-inch pipe; a short section of 8-inch pipe was laid in Leib street from the new 42-inch main in Champlain street to Monroe avenue, replacing 3-inch pipe; a line of 8-inch was also laid in Maybury avenue, from north of Warren to Stanley avenues; a short section of 8-inch pipe was laid in alley south of Monroe avenue east of Beaubien street; a line of this size was also laid in Park street, from Columbia to Bagg streets, replacing 4-inch pipe, this line connects with the 24-inch main in Bagg street and the 16-inch at the intersection of Park and Columbia streets; a 6-inch pipe was also laid in said street from Bagg to Peterboro streets, replacing 4-inch pipe; an 8-inch pipe was laid in Seminole avenue, from Agnes to St. Paul avenue; also an 8-inch in Trumbull avenue, from Fort street to Michigan avenue, this line connects with the 24-inch main in Abbott street, and the new line of 12-inch in Fort street; also the 8-inch line in Michigan avenue; 8-inch pipe was also laid in alley west of Woodward avenue as follows: alley north of Jefferson avenue to Larned street, Congress street to alley south of Fort street, and from alley north of Michigan avenue to Clifford street.

The above comprises the principal lines laid, the minor lines with the above appear in the attached list of pipe laid.

PIPEAGE.

The amount of distribution pipe and mains laid and relaid also for private use, and small lines of pipe discontinued during the past year, makes the sum total as follows: Total pipe laid $22\frac{4143}{5280}$ miles, of which 150 feet were relaid; 1,822 feet for private use and 444 feet laid for blow-offs to connect to sewers; $4\frac{370}{5280}$ miles of pipe discontinued, making the net increase of the pipeage $18\frac{1357}{5280}$ miles. with the works will make the total length $501\frac{2390}{5280}$ This amount added to the measured line of pipe connected miles, which in detail is as follows:

Size of Pipe in Inches.	Measured Length in Feet for 1894.	Added Length in Feet for 1895.	Discontinued Length in Feet for 1895.	Total Length in Feet for 1895.
45	103	....	....	103
42	45,207	14,302	....	59,509
36	715	....	....	715
30	49,337	....	22	49,315
24	84,813	28	....	84,841
20	461	....	....	461
18	87	....	....	87
16	45,237	....	....	45,237
12	12,119	4,899	....	17,018
10	128,584	9,100	....	137,684
8	257,436	21,054	....	278,490
6	1,048,453	59,154	3,934	1,103,673
4	801,100	9,175	15,488	794,787
3	73,257	175	2,046	71,386
2	2,820	....	....	2,820
Total,	2,550,729	117,887	21,490	2,646,126

Of the pipe laid as appearing in the above mentioned Table of Pipeage, $1\frac{60}{5280}$ miles was laid beyond the city limits, 1,122 feet of which was 4-inch and 4,218 feet of 6-inch pipe; this will appear in the list of pipeage. The total cost of which was met by the petitioners asking for these extensions.

You will see by the perusal of this report no mention is made of log pipe being yet in use, practically it is out; the line in alley north of Grand River avenue, from Lincoln avenue to alley west of same is dead, and that in the abandoned section of Holden avenue, between Second and Third avenues, is still left temporarily in use, two or three service connections still taking supply from it until pipe shall be laid in new location of street.

The following is a table of pipeage as arranged by wards:

The following table gives a lucid statement of the average cost of each size of pipe and main as laid, also cost per foot and pro rata of per cent of total cost, of the entire extensions, for the past season's work:

TABLE OF PRO-RATA OF PER CENT. OF TOTAL COST, COST PER FOOT, AND TOTAL COST OF EACH LINE, AS LAID THE PAST YEAR:

DIAM. OF PIPE IN INCHES.	PRO-RATA OF PER CENT. OF TOTAL COST.	TOTAL COST OF EACH SIZE OF PIPE LAID.	TOTAL LENGTH IN FEET.	COST PER FOOT.
42	.6715	$165,169.942830	14,302	$11.5400
24	.0000	000,000.000000	28	00.0000
12	.0316	7,772.703192	4,899	1.5870
10	.0469	11,536.068978	9,100	1.2677
8	.0742	18,251.094204	21,054	.8670
6	.1605	39,478.445010	59,154	.6678
4	.0151	3,714.171462	9,175	.4048
3	.0002	49.194324	175	.2890
	1.0000	$245,971.620000	117,887	

The 28 feet of 24-inch pipe was laid in connection with the 42-inch force main, the estimated cost of which is set at $133.94, or $4.7835 per foot; this amount is deducted from the total cost of the 42-inch main in making the estimated cost per foot, as appearing in the table of cost.

On the following pages will be found the Tables of Gates, giving number and size in use, number set the past year, number taken out and number reset either for stop or blow-offs.

I take the liberty of giving a description of the 42-inch hydraulic pressure gates that have been set in the new line of force main; these gates were made by the Michigan Brass & Iron Works, of this city, and from the general appearance of the same and the apparent good workmanship they have much to recommend them as to quality.

42-INCH HYDRAULIC PRESSURE GATES.

The water gates set in the new line of 42-inch main are operated by hydraulic pressure. They differ from the ordinary kind now in use on our system, in that the screw spindle is replaced by a single piston rod with piston head secured to its outer end, the inner end being secured to the disks; a cylinder is attached to the body of the gate allowing sufficient space between body of gate and inner head of cylinder for stuffing boxes and glands, the gates laying horizontally. The cylinder has a diameter of sufficient area to overcome the friction due the pressure of the water in the mains upon the disks of the gates. Each gate has an 8-inch by-pass attachment, also a blow-off gate opening on under side of valve or disk chamber, for the displacement of whatever of sediment may accumulate at this point, and that would in any way impede the free working of the same. We hope by this method to be able to operate the opening and closing of the valve with less labor and time.

A question arises, however, that when the same has been in use for several years and the lime formation which appears upon the spindles and disks of the water gates, after continued use (which is the chief cause of the gates working hard), will not be the same with the hydraulic piston arrangement. For operating the working of these gates, the men in charge of this department will have to enter the gate wells for working the same, and to see when opened or closed. The gates have a 1½-inch pipe attachment to either end of cylinder, leading from both sides of the by-pass gate, from which the pressure is applied to the cylinder and to which may be connected any other of the pipeage should it become necessary to do so when the pressure in the force mains is dead. . Should we find it still requiring a greater pressure than that upon the mains and distribution pipes to operate the gates, an appliance is had by the attachment of a small pressure pump which will in any event accomplish the purpose intended by this arrangement.

Since preparing this report the 42-inch hydraulic pressure gates have been properly connected to the adjoining main by the attachment of the small pipes for applying the water pressure to the cylinders. The result thus far in operating the gates by hydrostatic pressure is very satisfactory, the time we took in operating the disks was about six minutes, three minutes each way, the pressure being on the main in which the said gates are set from the smaller lines, the direct pressure from the Pumping Works being not yet applied. The closing of the gates may be operated in much less time if so desired by a freer injection of the water into the cylinders. Any greater acceleration of speed than this may, under some conditions, prove to be very disastrous; the quick closing would in all probability cause serious rupture to the mains, but a little common sense will avoid all of this by simply adjusting the discharge leading to and from either end of the cylinder to such a degree that the disks shall not be propelled too rapidly.

I have thought it wise to mention at this point of the report that in speaking of the force mains, I have mentioned the lower as No. 1 main and the line just completed as the new line. Prior to this the line of mains in use conveying the supply to the city have been designated the upper and lower. Now seeing that the said new line is virtually a lower or dual line, would it not now be better to distinguish them by numbering them Nos. 1, 2 and 3 respectively?

TABLE OF NEW GATES SET FOR SHUT-OFFS.

No. of each kind.	NAME OF GATE.	SIZE.	REMARKS.
1	Murdock Valve Company..............	42-in.	Set for Shut-off.
6	" " "	12-in.	" "
12	" " "	10-in.	" "
34	" " "	8-in.	" "
38	" " "	6-in.	" "
34	" " "	4-in.	" "
9	" " "	4-in.	Set for Blow-off.
10	Michigan Brass and Iron Works........	42-in.	Set for Shut-off.
1	" " "	30-in.	" "
2	" " "	24-in.	" "
3	" " "	12-in.	" "
4	" " "	10-in.	" "
63	" " "	8 in.	" "
3	" " "	8-in.	Set for Blow-off.
151	" " "	6-in.	Set for Shut-off.
15	" " "	6-in.	Set for Blow-off.
9	" " "	4-in.	Set for Shut-off.
6	" " "	4-in.	Set for Blow-off.
398	Total.		

TABLE OF OLD GATES RESET FOR SHUT AND BLOW-OFFS.

No. of each kind.	NAME OF GATE.	SIZE.	REMARKS.
1	Flowers Bros..........................	6-in.	Set Shut-off.
12	" "	4-in.	" "
29	" "	4-in.	Set Blow-off.
6	" "	4-in.	Reset Blow-off.
1	Murdock Valve Company.............	6-in.	" "
5	" " "	4-in.	" "
1	Galvin Bros..........................	4-in.	" "
1	" "	4-in.	Set Blow-off.
2	Ludlow..............................	4-in.	Reset Blow-off.
2	Pittsburgh	4-in.	" "
60	Total.		

TABLE OF GATES TAKEN OUT.

No. of each kind.	NAME OF GATE.	SIZE.
1	Michigan Brass and Iron Works	6-in.
1	" " " "	4-in.
1	Eddy	24-in.
3	Flowers Bros	6-in.
13	" "	4-in.
8	Galvin Bros	4-in.
2	Ludlow	4-in.
7	Murdock Valve Company	6-in.
44	" " "	4-in.
4	Pittsburgh	4-in.
1	Scowden	8-in.
85	Total.	

GATES IN SYSTEM TO JANUARY 1ST, [illegible].

	48-In.	36-In.	30-In.	24-In.	20-In.	18-In.	16-In.	12-In.	10-In.	8-In.	6-In.	4-In.	3-In.	Total.	Per Cent.
Murdock	5	...	11	16	...	...	24	27	167	485	1,482	1,225	9	3,401	58.087
Flowers	20	...	10	18	...	...	...	...	39	52	241	447	22	849	14 500
Galvin Bros	...	1	7	12	...	...	21	...	12	32	171	268	1	525	8.967
Michigan Brass and Iron Works	10	...	1	2	10	...	7	8	26	87	502	107	...	760	12.980
Pittsburgh	...	...	...	13	...	2	1	1	9	11	31	129	...	197	3.365
Eddy	...	...	...	...	...	...	...	...	15	4	6	9	...	34	0.580
Scowden	...	...	...	...	...	...	...	...	3	2	....	....	...	5	0.086
Ludlow	...	...	...	...	...	...	...	...	1	3	11	13	...	28	0.478
Prong	...	...	...	...	...	...	...	...	....	....	1	....	...	1	0.017
Boston	...	...	...	...	...	...	...	...	....	1	1	....	...	2	0.034
Newport	...	...	...	...	...	...	...	...	....	....	....	1	...	1	0.017
No Name	...	...	...	...	...	...	...	...	....	3	9	39	1	52	0.889
TOTAL	35	1	29	61	10	2	53	36	272	630	2,455	2,238	33	5,855	100.000

The last mentioned table gives the total number of water-gates in the pipeage system, name of maker, number of each size and percentage of each manufacture. The following table gives the length of 3, 4, 6 and 30-inch pipe which have been replaced with pipe of larger size, in detail as follows:

SIZE OF PIPE LAID.	SIZE OF PIPE REPLACED.	LENGTH OF PIPE LAID.
6-inch iron pipe..........	3-inch iron pipe.........	781 feet.
6 " " "	4 " " "	4,814 "
6 " " "	6 " " "	131 "
8 " " "	3 " " "	970 "
8 " " "	4 " " "	6,545 "
8 " " "	6 " " "	200 "
10 " " "	4 " " "	430 "
12 " " "	4 " " "	412 "
12 " " "	6 " " "	1,226 "
42 " " "	4 " " "	3,567 "
42 " " "	6 " " "	2,097 "
42 " " "	30 " " "	22 "
TOTAL...............	....	21,195 "

PUMPING WORKS.

We are now at work at this point making our final connections with the two lines of force mains and the four engines. When this is completed with all the attendant alterations, the arrangement of this system of force mains will be very complete, working conjointly with or independent of each other. I may add of the above, that had it not been for the unfavorable weather and other causes which I had no control of, I should have been able to report its completion at the incoming of the new year. I hope, however, nothing preventing, I shall be able to report its completion by the next session of your honorable body.

WATER-GATE DEPARTMENT.

The complications incident to this branch of the work and the necessary skillful handling required of the same has een very satisfactorily met under the efficient supervision f Mr. John Bridge and the men in his immediate employ. or the detailed items of this department see appended re-ort.

OFFICE OF EXTENSION DEPARTMENT.

The profusion of clerical work of this department under he efficient supervision of Mr. A. W. Goodsell and his corps f assistants will make a very satisfactory showing of the ompleteness of the records as kept in this department of the works.

In conclusion, I am pleased to say as in my former report that it would be a breach of courtesy not to mention your kindness and forbearance of the many calls we have had to make upon your attention. I am also pleased to say that the co-operation with the several departments of the works has been of a pleasant character.

Transmitted with this report is an inventory of tools, pipe and specials, office equipments and locations of the pipeage of the city to January 2, 1896.

Respectfully submitted,

HENRY BRIDGE,
Superintendent of Extensions.

VALUATION OF THE WORKS.

AGGREGATES.

Real estate	$ 418,427 29
Oil plant	14,649 29
Buildings, docks, basins, conduits, force mains at pumping works	980,384 81
Water pipe laid and in use	3,585,377 34
Meters placed and in use	91,571 58
Horses, vehicles and harnesses	7,641 50
Office furniture and fixtures	12,546 66

TOOLS AND MATERIALS ON HAND.

In Repair Department	648 75
In Meter Department	2,360 31
In Service Connection Department	1,873 85
In Iron Pipe Department	44,249 43
In Pumping Water and Works Department	25,187 02
In Hurlbut Fund Department	1,250 05
Aggregate	$5,186,167 88

The above valuation consists in details as follows:

REAL ESTATE.

Office building and lot	$ 60,000 00	
Orleans street lots	33,750 00	
Storage grounds and improvements	53,200 00	
Pumping Works grounds and improvements	271,477 29	
		$418,427 29

OIL PLANT.

Pumping station house, engines and pipes, tank and fixtures at works	$14,649 29

PUMPING WORKS.

Buildings, dock, basin, conduits, pipe, etc.	$980,384 81
Tools	1,131 77
Materials—Rope, waste, etc.	1,446 11
Materials—Gauges, valves, etc.	992 93
Materials—Iron, lead, etc.	764 58

Furniture	$ 297 05	
Wood and coal	14,375 21	
Fuel oil (118,954 gals.)	2,593 20	
Hoisting engines, pony pumps and boilers, electric light plant and stock, gas machines, etc.....	3,586 17	
Tools, materials and settees, Hurlbut Fund	1,250 05	
		$1,006,821 88

OFFICE BUILDING.

Counter	in office..........	$1,000 00
Fourteen office tables	" "	215 00
Six book cases	" "	660 00
Three wardrobes	" "	335 00
Ten desks	" "	262 00
Thirty-seven chairs	" "	95 00
Thirteen office stools	" "	40 00
Two city maps	" "	40 00
One marble clock	" "	100 00
One atlas map	" "	25 00
Partitions and railings	" "	800 00
Heating apparatus	" "	1,400 00
Electric light fixtures	" "	85 00
Miscellaneous properties	" "	100 00
Furniture in board room.................		575 00
Furniture in Secretary's room (excepting desk) in office......................		85 00
Two book stands	in office..........	5 00
Annunciator	" "	40 00
Engineering instruments	in engin'r'g dep't	856 50
1 book of city plats	" " "	40 00
Old maps, plats and records	" "	1,500 00
New maps, plats and records	" "	3,500 00
Books and papers	" "	50 00
2 cases for drawings	" "	130 00
6 draughting tables	" "	75 00
7 stools	" "	20 00
Draughting boards, table and horses	"	30 00
Blue printing outfit	"	50 00
Roll top desk, table and 6 chairs	"	78 00
Tee squares, straight edges, etc.	"	10 00
Safe	"	50 00
Paper, vellum, ink and supplies	"	25 50
8 desks	in Supt. of Ex. room	145 00
1 table	" " " "	4 50
18 chairs	" " " "	38 00
1 copy press and stand	" " " "	10 00
8 inkwells	" " " "	6 00

1 clock	in Supt. of Ex. room	$12 00	
1 numbering stamp	" " " "	7 50	
1 wash stand	" " " "	26 66	
Blanks and stationery	" " " "	20 00	
			$12,546 6

REPAIR DEPARTMENT.

2 sleighs	$ 25 00
2 sets runners	20 00
5 horse blankets	17 00
2 sets calking tools	1 50
425 lbs. pig lead	14 00
870 lbs. scrap lead	25 00
54 lbs. sheet lead	2 70
1100 lbs. old brass	77 00
140 lbs. wiping solder	14 00
35 lbs. strap solder	1 75
180 lbs. 1½-in. lead pipe	9 40
175 lbs. 1-in. lead pipe	7 45
170 lbs. ¾-in. lead pipe	7 20
140 lbs. ⅝-in. lead pipe	5 95
8 ladles	12 00
1 plumber's fire pot	5 00
12 diamond-pointed chisels	12 00
12 flat chisels	6 00
1 anvil	2 50
2 vises	8 00
28 gate keys	33 00
14 street keys	14 00
4 pumps	75 00
12 hydrant wrenches	4 50
6 dippers	3 00
6 pairs rubber boots	24 00
2 leather coats	8 00
12 shovels	8 00
14 picks	14 00
6 pounders	6 00
20 lanterns, 18 red globes	20 00
2 saws	1 25
1 draw knife	50
1 rope ladder	1 00
1 platform scale	25 00
2 force pumps	8 00
1 grindstone	1 25
8 water pails	2 00
70 ft. ⅝-in. hose	5 00
2 wheelbarrows	5 50
1 sledge	1 00

6 6-in. bolted sleeves	$12 00	
14 4-in. bolted sleeves	15 75	
3 3-in. bolted sleeves	82	
6 3-in. plain sleeves	3 90	
2 4-in. plain sleeves	1 13	
1 8-in. plain sleeve	1 76	
2 3-in. bends	1 80	
3 4-in. Flowers gate stems	5 25	
6 4-in. Mich. Brass & Iron Wks stems	10 50	
4 6-in. Mich. Brass & Iron Wks stems	9 60	
4 4-in. Murdock gate stems	7 00	
1 6-in. Murdock gate stem	3 00	
5 4-in. stuffing boxes, M. B	3 75	
4 6-in. stuffing boxes, M. B	3 20	
6 8-in. stuffing boxes, M. B	6 00	
1 4-in. stuffing box, Murdock	45	
5 crow bars	4 50	
1 machine for raising gate boxes	3 00	
2 axes	2 00	
3 4-in. caps for iron pipe	1 50	
3 6-in. caps for iron pipe	1 80	
2 4-in. iron plugs	70	
2 gate boxes	4 44	
1 3-in. tee	1 75	
9 chains	9 00	
1 5-gal. gasoline can	50	
1 2-gal. gasoline cane	20	
		$648 75

SERVICE COCKS.

1 Smith tapping machine	$850 00
2 2x4 Smith sleeve and valve	18 00
1 3x4 " " " "	10 00
1 4x4 " " " "	13 00
2 2x6 " " " "	23 00
1 3x6 " " " "	12 50
1 4x6 " " " "	16 00
2 2x8 " " " "	24 00
1 3x8 ' " " "	14 00
1 4x8 " " " "	18 00
1 2x10 " " " "	16 00
1 3x10 " " " "	18 00
1 4x10 " " " "	22 00
3 Mueller tapping machines	255 00
1 30-in. saddle	1 00
2 24-in. "	2 00
2 16-in. "	2 00
2 12-in. "	2 00

3	8-in. saddle	$3 00	
3	6-in. "	3 00	
3	4-in. "	3 00	
3	3-in. "	3 00	
5	yokes	5 00	
3	pressure wrenches	1 50	
3	tap handles	50	
9	1-in. drills	27 00	
2	¾-in. drills	5 00	
8	⅝-in. drills	16 00	
2	½-in. drills	3 50	
425	1-in. service cocks	229 50	
335	⅝-in. service cocks	103 85	
5	oil cans	1 00	
2	leather jackets	5 00	
2	pairs rubber boots	8 00	
1	Stilson wrench	75	
5	monkey wrenches	3 75	
1	emery wheel	2 00	
2	horse blankets	5 00	
8	horse blankets	24 00	
8	robes	24 00	
8	rubber covers	16 00	
8	rubber aprons for buggies	12 00	
8	tape lines	6 00	
8	pipe gauges	24 00	
8	street keys	12 00	
8	spades	6 00	
8	picks	4 00	
			$1,873

METER DEPARTMENT.

	Meters placed and in use		$91,571
1	foot lathe	$ 90 00	
1	water motor	50 00	
1	lathe chuck	4 00	
1	drill chuck	3 00	
	Turning tools, small drills and tap	4 20	
1	breast drill	1 75	
1	lathe clamp	1 12	
1	lathe plug for drill chuck	90	
1	set stock and dies ⅜- to 1-in.	30 00	
1	set stock and dies 1¼- to 2-in.		
1	set stock and dies 1- to 2-in. ratchet		
1	2-in. pipe cutter		
1	⅛-in. gas tap	30	
1	¼-in. gas tap	45	
1	2-in. gas tap	2 50	
1	1-in. pipe cutter	2 00	

1 2-in. pipe cutter		$4 00
1 3-in. pipe cutter		12 00
1 6-in. pipe cutter		15 00
10 cutter wheels		3 00
1 14-in. tramo wrench		3 00
1 6-in. monkey wrench		60
1 12-in. monkey wrench		1 00
2 18-in. monkey wrenches	at $2 50	5 00
8 combination wrenches		24 00
2 Crowfoot wrenches		2 00
2 sets of calking tools		1 90
1 calking hammer		3 00
3 pair pipe tongs	at $1 50	4 50
2 pair chain tongs	at $6 00	12 00
2 pipe vises		12 00
1 bench vise		3 00
1 hand vise		75
1 washer cutter		75
3 "S" wrenches		2 00
1 hollow punch		75
2 14-in. files		1 00
2 Westcott wrenches	at $1 25	2 50
3 small gate keys		3 00
1 long gate key		1 50
1 large gate key		4 00
1 nail puller		1 25
1 seal punch and lead seals		4 00
1 chain tackle		10 00
1 rope tackle		3 00
2 pair hip boots		8 00
1 hand oil can		35
1 one-gal. can		40
1 two-gal. can		60
1 five-gal. can		75
2 stop box augers		2 00
1 stop box shovel		50
4 cross cut saws		6 00
2 rip saws		3 00
4 hand axes		2 00
1 jack plane		50
1 wood chisel		50
1 extension bit and cutter		1 70
1 saw set		75
1 try square		50
2 fire pots	at $5 75	11 50
3 fire pots, old		6 00
4 small ladles		1 00
4 6-in. ladles		2 00

5 bailing dippers		$ 3 75	
5 hand pumps		15 00	
2 hand lanterns		60	
1 testing apparatus		30 00	
2 bicycles		50 00	
137 bushings		7 68	
107 reducers		6 45	
96 unions		15 41	
81 45° elbows		11 89	
61 street elbows		7 46	
72 elbows		7 26	
27 tees		2 38	
172 nipples		10 98	
72 couplings		3 70	
48 ft. pipe		3 36	
217 meter couplings		56 35	
26 solder nipples		3 85	
18 check valves		15 86	
9 stops		5 07	
140 lbs. ⅝-in. lead pipe	at 5¼c	7 37	
151 lbs. ¾-in. lead pipe	at 5¼c	7 95	
60 lbs. wiping solder	at 12c	7 20	
16 lbs. ½ and ½ solder	at 14c	2 24	
13½ lbs. tin	at 20c	2 70	
10 lbs. hemp packing	at 12c	1 20	
17 lbs. rubber packing	at 25c	4 25	
42 bolts for expansion joints	at 25c	10 50	
76 lbs. 2-in. expansion joints	at 1½c	1 14	
99 lbs. 3-in. expansion joints	at 1½c	1 48	
264 lbs. 4-in. expansion joints	at 1½c	3 96	
42 lbs. 2-in. sleeves	at 1½c	63	
66 lbs. 3-in. sleeves	at 1½c	99	
31 lbs. 4-in. sleeves	at 1½c	47	
1 4-in. gate		5 00	
1 dirt pounder		1 00	
10 2-in. nipples	at 15c	1 50	
5 3-in. nipples	at 60c	3 00	
3 4-in. nipples	at 80c	2 40	
2,389 lbs. old covers	at 1½c	35 83	
2,110 lbs. new brick well covers	at 1½c	31 65	
1,096 ft. hemlock lumber	at $11 00	12 05	
249 ft. pine lumber	at $20 00	4 98	
Meters in stock		1,575 00	
			$2,360 3

IRON PIPE DEPARTMENT.

PIPE IN GROUND.

103 feet 45-in. pipe	$ 1,699 50	
59,509 " 42 "	825,366 34	
715 " 36 "	6,587 35	
49,315 " 30 "	322,261 10	
84,841 " 24 "	403,838 87	
461 " 20 "	1,751 80	
87 " 18 "	278 40	
45,237 " 16 "	140,163 78	
17,018 " 12 "	32,671 34	
137,684 " 10 "	211,309 48	
278,490 " 8 "	318,553 16	
1,103,673 " 6 "	788,236 53	
794,787 " 4 "	496,497 97	
71,386 " 3 "	35,409 62	
2,820 " 2 "	752 10	
		$3,585,377 34
2,646,126 total feet.		

STOCK AT RESERVOIR.

Iron pipe	$ 25,947 29	
Specials	6,057 89	
Gates and valves	1,646 41	
Gate boxes	674 10	
Gate well covers and cylinders	281 63	
Lead	983 02	
Packing	15 71	
Oil	3 08	
Coal	80 25	
Scrap iron	1,936 81	
Tools	5,985 09	
Tile, brick and cement	50 00	
Office fixtures	93 75	
Covers and blankets	70 00	
Feed, etc.	424 40	
		$44,249 43

HORSES AND WAGONS.

1 horse, phaeton, cutter and harness—Office	$ 305 00
1 horse, vehicle and harness—Pumping Works	130 00
2 horses, 2 wagons and 2 sets of harness, 2 sets of runners, etc.—Meter	357 50

5 horses, 5 wagons, 1 carriage and 5 sets of harness—Repairing Leaks........	$750 00	
2 horses, 2 wagons, 2 sets of harness—Service Connections	400 00	
6 buggies, 2 carts and 8 sets of harness—Service Connections	720 00	
1 horse, cart and harness—Hurlbut Fund	150 00	
14 horses, 6 wagons, 6 trucks, 1 cart, 5 buggies, 17 sets of harness, 1 sleigh, 1 cutter, 2 pair runners—Iron Pipe.....	4,829 00	
		$7,641 50
Aggregate		$5,186,167 88

SUPPLEMENT.

BOARD OF MANAGEMENT OF DETROIT WATER WORKS.

Board of Trustees appointed by Common Council, February 24th, 1852; organized March 1st, 1852.

Shubael Conant, Chairman. Edmund A. Brush.
Henry Ledyard. Jas. A. Van Dyke.
Wm. R. Noyes.

1853.

On the 16th of May, 1853, the Board of Water Commissioners of the City of Detroit, was organized under an act previously approved by the Common Council and passed by the Legislature, February 14th, 1853. The term of service was determined by lot, as follows:

James A. Van Dyke	**for 3 years**
Edmund A. Brush	**for 4 years**
Henry Ledyard	**for 5 years**
Shubael Conant	**for 6 years**
William R. Noyes	**for 7 years**

Shubael Conant was elected President, who, finding the **duties** too arduous, resigned July 30th, and Edmund A. **Brush** was elected.

1854.

Edmund A. Brush, President. William R. Noyes.
Shubael Conant. James A. Van Dyke.
Henry Ledyard.

1855.

Edmund A. Brush, President.
Henry Ledyard.
Shubael Conant.
William R. Noyes.
James A. Van Dyke, died May 8th.
A. D. Fraser, appointed to fill vacancy.

1856.

Edmund A. Brush, President.
Shubael Conant.
William R. Noyes.
Alexander D. Fraser, re-appointed May 1st, for 5 years.
Henry Ledyard.

1857.

Edmund A. Brush, President, re-appointed May 1st, for 5 years.
Henry Ledyard.
Alexander D. Fraser.
William R. Noyes.
Shubael Conant.

1858.

Edmund A. Brush, President.
Shubael Conant.
Alexander D. Fraser.
Henry Ledyard, re-appointed May 1st, for 5 years.
William R. Noyes.

1859.

Edmund A. Brush, President.
Alexander D. Fraser.
William R. Noyes.
Shubael Conant, term expired May 1st, and
Julius D. Morton, appointed for 5 years.
Henry Ledyard, vacated by removal from city, and
John V. Ruehle, appointed May 1st to fill vacancy.

1860.

Edmund A. Brush, President.
Alexander D. Fraser.
Julius D. Morton.
William R. Noyes, re-appointed May 1st, for 5 years.
John V. Ruehle.

1861.

ınd A. Brush, President.
xander D. Fraser, re-ap-
inted May 1, for 5 years.

Jno. V. Ruehle, resigned Sept. 16th, and
Chauncey Hurlbut, appointed to fill vacancy.

1862.

dmund A. Brush, President.
re-appointed May 1st, for
5 years.

William R. Noyes.
Julius D. Morton.
Chauncey Hurlbut.

Alexander D. Fraser.

1863.

Edmund A. Brush, President.
Alexander D. Fraser.
William R. Noyes.
Julius D. Morton.

Chauncey Hurlbut, term expired May 1st, and
Stanley G. Wight, appointed for 5 years.

1864.

Edmund A. Brush, President.
Alexander D. Fraser.
William R. Noyes.

Julius D. Morton, term expired May 1st.
Stanley G. Wight.

1865.

Edmund A. Brush, President.
William R. Noyes, resigned Jan. 10, and Jacob S. Farrand, appointed to fill vacancy; term expired May 1; re-appointed for 5 years.
Alexander D. Fraser.

Stanley G. Wight.
Julius D. Morton, re-appointed for 5 years from May 1st, 1864; died Feb. 14, 1865, and
John Owen, appointed to fill vacancy.

1866.

Edmund A. Brush, President.
Alexander D. Fraser, re-appointed May 1, for 5 years.
Stanley G. Wight.
Jacob S. Farrand.
John Owen.

1867.

Edmund A. Brush, President. re-appointed May 1 for 5 years.
Alexander D. Fraser.
Jacob S. Farrand.
John Owen.
Stanley G. Wight.

1868.

*Edmund A. Brush, President.
Stanley G. Wight, term expired May 1, and
Chauncey Hurlbut, appointed for 5 years.
Jacob S. Farrand.
John Owen.
Caleb Van Husan.

*Edmund A. Brush resigned January 28, and Caleb Van Husan appointed to fill vacancy, and Alexander D. Fraser elected President.

1869.

Alex. D. Fraser, President.
John Owen, re-appointed May 1, for 5 years.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.

1870.

Alex. D. Fraser, President.
Jacob S. Farrand, re-appointed May 1, for 5 years.
John Owen.
Caleb Van Husan.
Chauncey Hurlbut.

1871.

*Alex. D. Fraser, President.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.
John Owen.

*Term expired May 1, and Samuel F. Hodge appointed for 5 years. Jacob S. Farrand elected President.

1872.

S. Farrand, President. *Caleb Van Husan.
Owen. Samuel F. Hodge.
Chauncey Hurlbut.

Term expired May 1st, and Elija Smith appointed for 5 years.

1873.

hauncey Hurlbut, President. Jacob S. Farrand.
ohn Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed. Elected President May, 1872.

1874.

hauncey Hurlbut, President. Jacob S. Farrand.
John Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1875.

Chauncey Hurlbut, President. *Jacob S. Farrand.
John Owen. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1876.

Chauncey Hurlbut, President. Jacob S. Farrand.
John Owen. *Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1877.

Chauncey Hurlbut, President. Jacob S. Farrand.
John Owen. Samuel F. Hodge.
*Michael Martz.

*Elija Smith's term expired and Michael Martz appointed to fill vacancy.

1878.

*Chauncey Hurlbut, President.
Jacob S. Farrand.
John Owen.
Samuel F. Hodge.
Michael Martz.

*Term expired and re-appointed.

1879.

Chauncey Hurlbut, President.
Jacob S. Farrand.
Michael Martz.
*James Beatty.
*John Pridgeon.

*John Owen's term expired and John Pridgeon appointed to fill vacancy. Samuel F. Hodge resigned and James Beatty appointed to fill vacancy.

1880.

Chauncey Hurlbut, President.
*Jacob S. Farrand.
Michael Martz.
James Beatty.
John Pridgeon.

*Term expired and re-appointed.

1881.

Chauncey Hurlbut, President.
Jacob S. Farrand.
Michael Martz.
*James Beatty.
John Pridgeon.

*Term expired and re-appointed.

1882.

Chauncey Hurlbut, President.
James Beatty.
*Michael Martz.
John Pridgeon.
Jacob S. Farrand.

*Term expired and re-appointed.

1883.

*Chauncey Hurlbut, President.
Jacob S. Farrand.
Michael Martz.
James Beatty.
John Pridgeon.

*Term expired and re-appointed.

1884.

uncey Hurlbut, President. Jacob S. Farrand.
chael Martz. James Beatty.
*John Pridgeon.

*Term expired; Marshall H. Godfrey appointed.

1885.

*Jacob S. Farrand, President. Michael Martz.
Marshall H. Godfrey. *Edwin F. Conley.
*Samuel G. Caskey.

*James Beatty died and Edwin F. Conely appointed to fill vacancy.

*Chauncey Hurlbut died and Samuel G. Caskey appointed to fill vacancy.

*Jacob S. Farrand's term expired and re-appointed.

1886.

Jacob S. Farrand, President. Michael Martz.
Marshall H. Godfrey. *John Pridgeon.
Samuel G. Caskey.

*Edwin F. Conely's term expired and John Pridgeon appointed to fill vacancy.

1887.

Jacob S. Farrand, President. John Pridgeon.
Marshall H. Godfrey. Samuel G. Caskey.
*Joseph Nagel.

*Michael Martz's term expired and Joseph Nagel appointed to fill vacancy.

1888.

Jacob S. Farrand, President. John Pridgeon.
Marshall H. Godfrey. *Samuel G. Caskey.
Joseph Nagel.

*Term expired and re-appointed.

1889.

Jacob S. Farrand, President. John Pridgeon.
Samuel G. Caskey. Joseph Nagel.
*August Goebel.

*Marshall H. Godfrey resigned January 1, 1889. August Goebel appointed to fill vacancy. Term expired May 1st, and re-appointed.

1890.

John Pridgeon, President.
August Goebel.
Joseph Nagel.
*Henry M. Duffield.
Samuel G. Caskey.

*Jacob S. Farrand's term expired, and Col. Duffield was appointed to fill vacancy July 9th. 1890; John Pridgeon resigned as President of the Board, on account of ill-health, and Henry M. Duffield was elected to fill vacancy.

1891.

Henry M. Duffield, President.
*John Pridgeon.
August Goebel.
Samuel G. Caskey.
Joseph L. Hudson.

*John Pridgeon's term expired May 1st, and Frank E. Kirby was appointed for a term of 5 years.

1892.

Samuel G. Caskey, President.
Henry M. Duffield.
August Goebel.
Joseph L. Hudson.
Frank E. Kirby.

1893.

August Goebel, President.
Samuel G. Caskey.
Frank E. Kirby.
Henry M. Duffield.
Joseph L. Hudson.

1894.

Henry M. Duffield, President.
Frank E. Kirby.
Albert L. Stephens.
DeWitt H. Moreland.
Edward W. Pendleton.

1895.

Frank E. Kirby, President.
Albert L. Stephens.
DeWitt H. Moreland.
Edward W. Pendleton.
Darius D. Thorp.

CHANGES IN STREET NAMES 1896.

WHERE RUN FROM AND LOCATED BY WARD AND PRECINCT.

The following appended lists give the names of streets newly opened, and also changes in names of streets up to January 1st, 1896 :

PRESENT NAME.	FORMER NAME.	RUNS FROM	LOCATED IN	
			Ward.	Precinct.
Bancroft ave	Williams ave. and Joy road	W. from Woodward	2-4	9-8
Barker ave	Ferry ave	E. from McClellan.	15	5
Barry st	Willis ave	E. from McClellan.	15	5
Beals ave	Thorburn st	S. from Mack.	15	3
Beaman st	Sherman st	W. from Crane.	15	4
Belvidere ave	Company and Bolde aves.	N. from Jefferson.	15	4-5
Bingham st	Forest ave	E. from Cadillac.	15	5
Blair st	Palmer ave	E. from McClellan.	15	5
Bradley st	Mullett st.	W. from Crane.	15	4
Brock st	Lincoln ave	N. from Lothrop.	6	8
Bruce st	Champlain st	W. from Crane.	15	4
Buhl st	Canfield ave	E. from Holcomb.	15	5
Burlingame ave	Englewood ave	W. from Woodward	2-4	9-8
Cadillac ave	Cadillac boulevard	N. from Jefferson.	15	4-5
Calumet ave	Brigham st	W from Third.	4-6-8	6-6-7
Canton ave	Godfrey ave	N. from Centerline road.	15	6
Carlton st	Forest ave	E. from McClellan.	15	5
Carver st	Commonwealth ave	N. from Lothrop.	8	8
Chapin st	Hendrie and Medbury	E. from Fischer ave	15	5
Clay ave	Pallister ave	E. from Woodward.	1-3-5-7-9	8-8-7-6-6
Conger st	Piquette ave	E. from Baldwin.	15	6
Cook st	Poplar st	E. from Welch ave.	16	5
Crane ave	Laclede ave	N. from Mack ave.	5	5
Crary st	Clinton ave	W. fromCrane ave.	15	4
Crawford Boul'd.	Hamilton ave	N. from Bancroft.	4-6	8-9
Cresswell st	Kirby ave	E. from McClellan.	15	5
Dallas st	Morton st	E. from Riopelle.	7	6
Deming st	Gilbert st	E. from Scotten.	14	3
Dillon ave	Lincoln ave	N. from Holden.	8	8
Douglas st	Warren ave	E. from McClellan.	15	5
Duncan st	Milwaukee ave	E. from Helen.	15	5
Durand st	Maple st	E. and W. from Van Dyke.	15	4-3
Eldred st	Chandler st	W. from Junction.	16	2
Emmons st	Julia H. st	E. from McClellan.	15	5
Erskine st	Calhoun st	W. from Gratiot.	1-11	5-4
Farnsworth ave.	Farnsworth st	Bet. Woodward and Mt. Elliott.	1-13	7-6
Fairbanks st	Lafayette place	E. from Scotten.	16	2

PRESENT NAME.	FORMER NAME.	RUNS FROM	LOCATED IN	
			Ward.	Precinct.
Felch st	Piquette	E. from McClellan.	15	5
Ferry ave	Kirby ave	E. from Baldwin.	15	6
Finley st	Custer ave	W. from Jos. C'mpau	11	7
Fisher ave	Janyne and Richard ave	N. from Mack.	15	5
Forest ave	Garfield ave	E. from McClellan.	15	5
Foster st	Beaufait ave	N. from Centerline road.	15	6
Frederick ave	Fredrick st	Bet. Woodward and Mt. Elliott.	1-13	7-6
Gillet st	Blaine and Chandler	W. from St. Aubin.	5	7
Goodwin st	Hastings st	N. from Holbrook.	3-5	8-7
Gordon st	Warren ave	E. from Cadillac.	15	5
Goethe st	Elm Grove ave	W. from McClellan.	15	4
Granger st	Palmer ave	E from Baldwin.	15	6
Graves st	Hancock ave	E. from Holcomb.	15	5
Greeley st	Riopelle st	N. from Reutter.	7	6
Greenwood ave	Crawford st	S. from Boulevard.	4-6	5-8
Grummond ave	Cleveland ave	W. from Woodward	2-4	9-8
Haigh ave	Bigelow and Andrus	W. from St. Aubin.	9	7
Hamilton boul'd.	Crawford st	N. from Boulevard to Bancroft.	4-6	8-8
Harper ave	Centerline rd & Buttler ave	N. City Line.	15	6
Hecla ave	Harrison ave	N. from Merrick.	8	8
Hendrie ave	Boulevard	E. from Baldwin.	15	6-5
Holcomb ave	Ackley ave	N. from Gratiot.	15	5
Homer st	Agnes ave	W. from Crane.	15	4
Houghton st.	Charles J. st	E. from Holcomb.	15	4
Hyde st	Harper and Trombly aves	E. from Helen.	15	6
Kellogg st	Baltimore ave	E. from Baldwin.	15	6
Kirby st	Farnsworth st	E. from Baldwin.	15	6
Kitchell st	Riopelle st	N. from Pallister.	7	6
Laclede ave	Parker ave	W. from Concord.	15	2
Ladue st.	Trombly ave	E. from Baldwin.	15	6
Lafayette ave	Volunteer ave	W. from McKinstry.	16	2
Laferty st	Laferty place	Howard to M.C.R.R.	8	1
Lambert st	Piquette and Kanter aves.	E. from Concord.	15	6
Leach st	Croghan st	W. from Crane.	15	4
Lernoult st	Farnsworth st	E. from McClellan.	15	5
Lincoln ave	Green ave	N. from Holden.	6	8
Longyear st	Harper ave	E. from Helen.	15	6
Lossing st	Orleans st	N. from Pallister.	7	6
Mack ave	Bellair st	Riopelle to Gratiot.	7-9-11-13	6-5-4
Marston ave	Lincoln ave	W. from St. Aubin.	9	7
Mathews st	Macomb st.	W. from Helen.	15	2
Maxwell ave	Morton ave	N. from Gratiot.	15	5
Merrill st	Seventh st	N. from Lothrop.	6	8
Miles st	Trombly ave	E. from Helen.	15	6
Moffat st	Frederick st	E from Holcomb.	15	5
Morley st	Avery ave	N. from Lothrop.	8	8
Morrell st	Theodore st	Bet. River and Fort streets.	16	1
Morrow st	Dequindre st	N. from Pallister.	7-9	6-7
Murray st	Theodore st	E. from McClellan.	15	5
Norvell st	Canfield ave	E from Van Dyke.	15	5
Oakland ave	Jerome ave	N. from Piquette.	3	8
Olney st	Whitaker ave	E. from Russell.	7	6
Palmer ave	Ferry ave	E. from Baldwin.	15	6
Parker ave	Belle Isle ave	E. from Van Dyke.	15	4
Parkman ave	Irving and Fourth aves	W. from Woodward	2-4	9-8
Phelps st	Harper ave	E. from Baldwin.	15	6
Philadelphia ave	Moeller st	E from Russell.	7	6
Pollard st	Horton ave	W. from Jos. C'mpau	9-11	7-7
Ransom st	Canfield ave	E. from Cadillac.	15	5
Rivard st	Prospect ave	N. from Pallister.	5	7
Rohns ave	Crane ave	N. from Mack.	15	5
Seward ave	Fifth ave	W. from Woodward	2-4-6-8	9-8
Seyburn ave	Morross ave	S. from Gratiot.	15	3
Sherwood ave	Belleview and Cleveland	N. from Harper.	15	6
Sidney ave	Whitaker st	E. from Russell.	5	7
Sprague st	Willis ave.	E. from Van Dyke.	15	5
Stanton ave	Seventeenth st	N. from Gd River.	10	8

AME.	FORMER NAME.	RUNS FROM	LOCATED IN	
			Ward.	Precinct.
e......	Trumbull ave..............	N. from Holden.	8	8
....	Superior st................	E. from Van Dyke.	15	5
....	Superior st..............	E. and W. from Concord.	15	6
....	Gladstone st.........	E. from Vinewood.	14	5
t...	Alexandrine and De Vogaelaer...............	E. from Van Dyke.	15	5
....	Raymond ave....	W. from Woodward	2-4-6-8	9-8
st....	Laferty st.................	S. from Howard.	8	1
....	Parker st................	E. and W. from Van Dyke.	15	3-4
st....	Sargent st.........	E. from Baldwin.	15	6
...	Plymouth road............	W. from 24th.	12-14	6-5
......	Wilkins ave................	W. from Woodward	4	8
ave..	Reutter st...	E. from Russell.	7	6
......	Frederick...........	E. from Baldwin.	15	6
....	Endicott ave.......	E. from Lincoln.	6	8
....	Hancock ave	E from Van Dyke.	15	5
....	Harper......	E. from Cadillac.	15	5

STREETS NEWLY OPENED.

LOCATED BY WARDS AND PRECINCTS, JANUARY 1896.

	WARD.	PRECINCT.
Adel St.—N. from Harper	9-11	7
Adele St.—St. Aubin to Chene	9-11	7
Amsterdam St.—Cass to Third	2-4	8
Annetta Ave.—N. from Caniff to N. City Line	3	8
Antoinette St.—Woodward to Third	2-4	8
Beach Place—from the River to Edgemere Boulevard	15	1
Beck St.—from Parkman to N. of Seward	4	8
Beneteau St.—N. from Jefferson E. of City Limits	....	....
Berlin St.—from Elmwood to Boulevard	13-15	2-4
Bohemian Ave.—Cass to Third	2-4	8
Brock Place—S. from Pallister	6	8
Brown Place—W. from Twenty-Sixth	14	5
Burrell Place—E. from Maybury Ave	12	6
Cameron Ave.—N. from Holbrook to City Line	5	7
Campau St.—Dix to Toledo	14	2
Canfield Ave.—Lincoln to Grand River	8	7
Canton Ave.—N. from Harper	15	6
Carter Place—E. from Twelfth	8-6	8
Carrie St.—N. from Harper	15	6
Chippewa Ave.—Gratiot to Harper	15	6
Church St.—E. and W. of Eleventh	8	2
Colburn Ave.—Cass to Third	2-4	8
Concord Ave.—N. from Harper	15	6
Dexter St.—N. from N. Boulevard	12	6
Duncan St.—Morton to Newland	15	6
Dyar Ave.—N. from Holbrook	7	6
Eastern Place—W. from Twenty-Sixth	14	5
Edgemere Boulevard—E. and W. from Beach Place	15	4
Elm St.—between Twelfth and Thirteenth	8	4-5
Ferry Ave.—Woodward to Third	2-4	7
Finley Ave.—W. from Jos. Campau	9-11	7
Fordyce Ave.—N. from Marston Ave	9-11	7
Foster St.—N. from Harper	15	6
Frank St.—Sixth to Seventh	6	6
G. A. R. St.—Welch to Hammond	16	5
Greenfield Ave.—S. from Pallister	6	8
Greusel St.—Otis to Michigan Ave	16	4
Gilbert Place—Twelfth to Hamilton Boulevard	8-6	8
Goodwin St.—N. from Holbrook to City Line	3-5	8-7
Hazel St.—between Harrison and Grand River	8	6
Helen Ave.—Macomb to Mack	15	2
Holden Ave.—Cass to Third	2-4	8
Iroquois St.—N. from Jefferson	15	4
Island View Boulevard—S. from Jefferson	15	1
Ironside St.—Welch to Hammond	16	5
J. P. Ave.—Clark to Scotten	14	1
Knox St.—from Holbrook to Gilette	7	6
Lambert St.—Morton to Newland	15	5
Lamson Place—S. from Pallister	6	8
Lee Place—E. from Twelfth	8	8
Le May St.—N. from Jefferson E. of City Limits	....	....
Lyman St.—W. from Chene	9-11	7

	WARD.	PRECINCT.
-N. of Holburn Ave	13	5
t.—Harper to Piquette	5	7
d Road—N. from Jefferson, E. of City Limits	....	....
St.—N. from Jefferson	15	4
lace—S. from Pallister	6	8
y Place—Rivard to Russell	5	7
Ave.—Morton to Newland	15	5
St.—N. from N. Boulevard (bet. 18th and Grand River)	12	6
St.—W. from Hamilton Boulevard	6-8	8-8
St.—N. from Clay and Hobrook	9	7
ace—W. from Twenty-Sixth	12	6
ve—Gratiot to Harper	15	5
t.—between D., G. H. & M. R. R. and Dyar	7	6
St.—Mack to Harper	15	5
Ave —N. of Jefferson, E. of City Limits	....	....
Ave.—W. from Jos. Campau	9-11	7
St.—N. of Jefferson, E. of City Limits	....	....
-N. and S. from Seward	4	8
w Boulevard—S. from Jefferson	15	4
t.—N. from Jefferson	15	4
ve.—W. from Jos Campau	9-11	7
St.—Seyburn to Van Dyke	15	3
e—N. from Mack	15	5
St.—N. from Holburn Ave	13	5
ace—W. from Twenty-Sixth	12	6
t.—Gratiot to Harper	15	5
St.—N. from Jefferson	15	4
d St.—N. from Harper	15	6
—Lysander to Forest	6	6
t.—Clark to Scotten	14	1
Ave.—Gratiot to Harper	15	5
St.—Mack to Harper	15	5
es St.—Harper to Strong	15	6
tus Place—Dequindre to St. Aubin	9	6
Road—N. from Jefferson, E of City Limits	....	....
St.—E. and W. from Van Dyke	15	6-5
e —N. Boulevard to N. of Bethune	4	8
St.—Gratiot to Hendrie	15	5
t.—between Twenty-Fourth and Scotten	12-14	2-3
Sixth St.—S. from Grand River	12	6
t —Woodward to Third	2-4	8
Place—E. from Dequindre	9	6
ve.—Ranspach to Michigan	16	4
ve.—E. from Lincoln	6	8
re St.—Welsch to Hammond	12	6

PIPE CONSTRUCTION, 1895.

The following is a detail list of the total lines laid, giving locations, size of pipe and length of same:

DATE.	LOCATION.	DIAMETER IN INCHES.							
		3	4	6	8	10	12	24	42
August 7	Adele st., 23 ft. w. of e. of Chene to 8 ft. w. of w. of same			56					
June 1	Agnes ave., 21 ft. w. of e. of Seminole to 20 ft. w. of e. of Iroquois				443				
November 8	Alfred st., 28 ft. e. of w. of Woodward to 16 ft. w. of e. of John R				733				
"	" 16 ft. w. of e. of John R to 3 ft. e. of w. of Brush			604					
July 23	Alger ave., 66 ft. w. of w. of John R to 108 ft. e. of e. of same			235					
September 19	Antietam st., crossing Jos. Campau			67					
July 25	Baldwin ave., s. line of Mack to 269 ft. s. of same			269					
November 14	Beaubien st., n. line of Champlain to 4 ft. s. of n. of alley s. of Monroe				152				
June 27	Bellevue ave., 25 ft. s. of s. of Frederick to 100 ft. n. of n. of same			184					
June 14	Belvidere ave., 4 ft. s. of s. of Mack to 177 ft. s. of same			173					
September 26	" 57 ft. n. of n. of Kercheval to 67 ft. s. of Lorman			530					
June 8	Boone st., 11 ft. e. of e. of Collins to 280 ft. w. of w. of Moran			390					
July 30	" 8 ft. e. of e. of McDougall Boulevard to 88 ft. e. of same			80					
July 26	Brown pl., 25 ft. w. of e. of Twenty-sixth to 146 ft. e. of e. of same			171					
May 3	Burlingame ave., 35 ft. w. of e. of Woodward to 1205 ft. w. of w. of same			1,260					
May 29	Burns ave., 51 ft. s. of n. of Jefferson to 300 ft. n. of same					359			
June	" 205 ft. n. of Jefferson to 2 ft. n. of St. Paul						1,417		
August 12	Burrell pl., 26 ft. w. of e. of Maybury to 213 ft. e. of Sullivan			724					
May 4	Cadillac sq., 283 ft. w. of Bates to 120 ft. e. of same		463						
October 3	Cameron ave., 26 ft. s. of n. to 99 ft. n. of n. of Haigh			123					
September 19	Catherine st., crossing Jos. Campau			12	58				
June 19	Cavalry ave., 36 ft. s. of n. of Fort to 18 ft. s. of n. of Celeron			432					
"	Celeron ave. 17 ft. w. of e. of Cavalry to 231 ft. e. of same			248					
November 8	Chase st., 23 ft. n. of s. of River st. to 430 ft. s. of same		477						
May 15	Champlain st., Chene to 19 ft. e. of w. of Crane								11,364
"	" Jefferson ave. connections				318		91		
September 19	Chestnut st., crossing Jos. Campau			70					
September 30	Church st., 178 ft. w. of w. of Eleventh to 27 ft. w. of e. of same			211					
June 3	" 27 ft. w. of e. of Eleventh to 78 ft. w. of w. of Tenth			305					
February 9	Commonwealth ave., 440 ft. s. of Piquette to 671 ft. s. of same			231					
June 12	Conger st., 21 ft. e. of w. of Baldwin to 160 ft w. of Van Dyke			321					
May 15	Crane ave., 22 ft. s. of n. of Jefferson to 42-inch Main							28	
July 19	Eastern ave., 25 ft. w. of e. of Twenty-sixth to 176 ft. e. of e. of same			201					
December 24	Eighth st., 28 ft. s. of n. of River st. to 12 ft. n. of n. of Abbott				1,587				

May 8	Eighth st., 12 ft. n. of n. of Abbott to 30 ft.								
"	" crossing n. side of Michigan								
September 26	" n. line of Michigan to 3 ft. n. of Orchard			318					
May 16	Eighteenth-and-a-half st., 504 ft. s. of River to 677 ft. s. of same	173							
"	" " 677 ft. s. of River to 857 ft. s. of same		180						
June 3	Ellery st., 25 ft. n. of s. of Pulford to 25 ft. n. of s. of Zender			298					
December 17, '94	Fort st., 20 ft. w. of e. of Tenth to 21 ft. w. of e. of Seventh						1,229		
September 27	" alley s. of 16 ft. w. of e. of Griswold to alley w. of Woodward				109				
November 28	Frederick st., 30 ft. w. of e. of Bellevue to 22 ft. e. of w. of Concord			376					
"	Frontenac Boulevard, 42-inch Main to 8 ft. n. of Champlain						54		
January 15	" " 8 ft. s. of n. of St. Paul to s. line of Waterloo, (e. side)		1,553						
"	" " s. line of Waterloo to 22 ft. s. of n. of Mack, (e. side)			2,719					
" 12	" " n. line of Gratiot to 11 ft. n. of n. of Farnsworth w.			780					
"	" " 4 ft. s. of n. of Farnsworth to 13 ft. n. of s. of Ferry, (w. side)			1,074					
"	" " 7 ft. n. of s. of Ferry to 13 ft. n. of s. of Hendrie, (w. side)			789					
Feb. and April 23	" " n. line of Mack to Gratiot, (e. side)					3,451			
June 17	" " 23 ft. n. of s. of Mack to n. line of same					43			
December 18	Greeley st., 18 ft. s. of n. of Alger to 10 ft. s. of n. of Gillet			540					
" 23	Gillet st., 10 ft. e. of w. of Greeley to 328 ft. e. of same			366					
June 27	Haigh ave., 158 ft. e. of Woodward to 668 ft. e. of same			510					
October 3	" 22 ft w. of e. of Russell to 22 ft. w. of e. of Cameron			656					
April 29	Hamilton ave., 689 ft. n. of n. of Canfield to 3 ft. s. of s. of Warren			941					
November 26	Harper ave., 29 ft. w. of e. of Thirteenth to 154 ft. e. of same			183					
May 23	Hastings st., 158 ft. s. of s. of Palmer to s. line of Medbury			972					
October 14	Hazel st., 25 ft. w. of e. of Harrison to 25 ft. w. of e. of National			284					
May 27	Hendrie ave., crossing Hastings			58					
June 13	" 24 ft. w. of e. of Van Dyke to w. line of Maxwell			566					
October 8	" alley s. of 378 ft. w. of Rivard to 16 ft. w. of e. of same			413					
February 2	Hendrie Boulevard, e. line of Collins to 32 ft w. of e. of McDougall Boulevard			431					
"	" 20 ft. w. of e. of Mt. Elliott to 12 ft. w. of e. of Collins					1,970			
January 1	" 12 ft. e. of w. of Frontenac to 20 ft. w. of e. of Mt. Elliott				2,545				
August 1	High st., 1 ft. e. of e. of Beaubien to 3 ft. w. of e. of St. Antoine			483					
February 25	Hubbard Boulevard, n. line of McGraw to 10 ft. n. of s. of Scovel		1,960						
September 19	Hudson ave., 18 ft. w. of e. of Fourteenth to 36 ft. e. of w. of Wabash			368					
May 11	Hussar st., 25 ft. w. of e. of Military to 204 ft. e. of same			229					
August 5	Illinois st., 4 ft. w. of w. of Collins to 4 ft. e. of same			48					
June 7	Iroquois ave., 6 ft. s. of Champlain to 21 ft. s. of n. of Agnes				702				
"	" 21 ft. s. of n. of Agnes to 2 ft. n. of n. of St. Paul			712					
June 10	" alley e. of 5 ft. n. of s. of alley n. of Jefferson to 115 ft. n. of same		130						
September 19	Jay st., crossing Jos. Campau			70					
May 15	Jefferson ave., 19 ft. e. of w. of Crane to Pumping Works grounds								3,382
June 10 and Aug.	" alley n. of 15 ft. w. of e. of Parker to 5 ft. w. of e. of alley e. of Iroquois		1,224						
January 17	Josephine ave., e. line of Woodward to 1,905 ft. e. of same			1,906					
September 19	Jos. Campau ave., 25 ft. n. of s. of Catherine to 20 ft. n. of s. of Jay				1,400				
May 23	Kercheval ave., 24 ft. e. of w. of Mt. Elliott to 97 ft. e. of e. of Beaufait				916				
May 20	King ave., 3 ft. e. of e. of Woodward to 871 ft. e. of e. of Brush			2,244					
June 16	Kirby ave., 24 ft. w. of e. of Maybury to 219 ft. e. of Sullivan			726					

PIPE CONSTRUCTION, 1895.—CONTINUED.

DATE.	LOCATION.	DIAMETER IN INCHES.							
		3	4	6	8	10	12	24	42
August 8	Kirby ave., 23 ft. w. of e. of Chene to 154 ft. e. of e. of same			177					
March 18	" 85 ft. w. of, to w. line of Moran			85					
May 4	Lafayette ave., e. line of Twenty-third to 1 ft. w. of w. of Twenty-second		314						
October 24	Larned st., alley s. of 2 ft. e. of e. of Griswold to 8 ft. w. of e. of alley w. of Woodward				91				
May 4	Lawrence ave., w. line of Woodward to 1212 w. of w. of same			1,212					
July 18	Leib st., 2 ft. n. of n. of Champlain to 18 ft. s. of n. of Monroe				327				
August 6	Leland st., w. line of Collins to 6 ft. e. of e. of same			46					
October 2	Lemay ave., 21 ft. s. of n. of Jefferson to 584 ft. n. of n. of same			605					
" 3	Lincoln ave., alley w. of s. line of Brainard to s. line of Calumet			1,840					
August 9	Lyman st., 4 ft. w. of w. of Chene to 23 ft. w. of e. of same			47					
Feb. 2 and March 8	McDougall Boulevard, 22 ft. n. of s. of Hendrie Boulevard to 29 ft. s. of n. of Griffin			2,790					
June 11	Mack ave., 80 ft. w. of w. of Rolf pl. to 16 ft. w. of e. of same				60				
"	Marston court, 125 ft. w. of w. of John R to 251 ft. e. of e. of same			436					
September 21	" 243 ft. w. of w. of Oakland to 27 ft. e. of w. of same			270					
June 18	Maxwell ave., alley n. of Jefferson to n. line of Champlain		386						
June 11	" 18 ft. s. of n. of Champlain to 16 ft. n. of s. of Tonti			546					
July and August 1	Maybury ave., 170 ft. n. of n. of Warren to 88 ft. s. of s. of Grand River				1,863				
June 1	Meldrum ave., crossing Kercheval			80					
September 16	" 168 ft. s. of s. of Forest to 30 ft. n. of s. of same			196					
August 1	Merrick ave., 27 ft. w. of e. of Maybury to 212 ft. e. of e. of Sullivan			724					
Feb. 15 and March	" 25 ft. w. of e. of Seventh to 20 ft. w. of e. of Greenwood			720					
September 7	Milwaukee ave., 4 ft. w. of w. of Eighteenth to the w. line of Sixteenth			790					
July 18	Monroe ave., 15 ft. e. of w. of Leib to 26 ft. e. of w. of Mt. Elliott			557					
November 14	" alley s. of 23 ft. e. of w. of Beaubien to 261 ft. e. of e. of same				298				
April 30	Montcalm st., crossing e. side of Clifford			29					
April 24	" crossing Park			60					
August 8	" e. line of Beaubien to 23 ft. e. of w. of St. Antoine			487					
May 1	Montclair ave., 844 ft. n. of n. of Mack to 6 ft. s. of s. of Canfield			800					
July 27	Moore pl., 25 ft. w. of e. of Twenty-sixth to 169 ft. e. of e. of same			194					
May 23	Newport ave., 70 ft. s. of n. of Jefferson to 397 ft. n. of n. of same			467					
June 24	Nineteenth st., s. to n. line of Porter, (s. side)			50					
November 23	North Boulevard, 330 ft. w. of w. of Grand River to 18 ft. e. of w.		345						
July 10	" " 595 ft. e. of e. of Grand River to 689 ft. e. of e. of same, (n. side)		44						
May 23	" " 1108 ft. w. of w. of Sullivan to 100 ft. w. of same, (n. side)		103						
July 8	" " 83 ft. w. of e. of Sullivan to 146 ft. e. of same, (s. side)		179						
May 9	" " 15 ft. w. of e. curb of Second to 69 ft. e. of same, (s. side)		84						

"	" " 20 ft. e. of w. of Dubois st., (n. side)								
May 7	Park ave., 514 ft. n. of n. of Canfield to 124 ft. n. of n. of Warren			1,300					
April 28	Park st., 17 ft. n. of s. of Columbia to 20 ft n. of s. of Bagg				2,031				
"	" 4 ft. s. of n. of Bagg to 25 ft. n. of s. of Peterboro			813					
May 15	Park View ave., s. line of Jefferson to 42-in main				44				
July 8	Parker ave., 6 ft. n. of s. of alley n. of Jefferson to 11 ft. n. of s. of Tonti			975					
May 27	Palmer ave., crossing Hastings			58					
September 14	" 100 ft. e. of e. of Moran to 300 ft. e. of e. of same			110					
July 10	Pennsylvania ave., 70 ft. s. of s. of Kercheval to 410 ft. n. of n. of same			560					
July 12	Perrien Park, 25 ft w. of e. of Chene to 410 ft. e. of e. of same		450						
January 2	Piquette ave., 29 ft. w. of e. of Fifth to w. line of alley			154					
October 10	Poplar st. 194 ft. w. of w. of Humboldt to 28 ft. w. of e. of same			230					
June 21	Porter st., 20 ft. w. of e. of Twentieth to 22 ft. e. of w. of Twenty-second				807				
May 27	" 30 ft. w. of e. of Fourteenth to 20 ft. w. of e. of Twentieth					1,950			
Dec. to Jan. 25	" 31 ft. w. of e. of Fourteenth to 9 ft. w. of w. of Tenth						2,108		
May 16	" alley s. of 8 ft. w. of e. of Thirteenth to 23 ft. e. of e. of same		81						
August 17	Putnam ave., 5 ft. e. of w. of alley e. of Second to w. line of Cass (s. side)			435					
September 24	" 34 ft. e. of w. of Cass to 318 ft. w. of same			330					
"	Rivard st., 33 ft. n. of s. of Harper to 126 ft n. of n. of same			172					
November 4	River Road, 55 ft. w. of w. of Dearborn to 49 ft. w. of Exposition ave			2,346					
" 26	" 22 ft. e. of w. of Pleasant ave. to 74 ft. e. of e. of Swain			410					
June 11	Rolf Place, 22 ft. s. of n. of Mack to 521 ft. n. of n. of same			548					
August 15	Rollin st., 41 ft. w. of e. of Wesson to 336 ft. e. of e. of same			377					
May 23 and June 26	Romeyn st., 26 ft. w. of e. of Campbell to 23 ft. e. of w. of Cavalry			560					
November 23	Second ave., alley w. of 16 ft. s. of n. of Putnam to 28 ft. n. of s. of Merrick			309					
August 10	" alley e. of 28 ft. n. of s. of Warren to 16 ft. n. of s. of Putnam			417					
May 16 and June	Seminole ave., alley e. of 6 ft. n. of s. of alley n. of Jefferson to n. line of Champlain		278						
June 1	" alley e. of n. line of Champlain to 21 ft. s. of n. of Agnes			664					
June 7	" 21 ft. s. of n. of Agnes to the n. line of St. Paul				712				
July 22	Scovel pl., 25 ft. w. of e. of Twenty-sixth to 208 feet e. of e. of same			226					
September 17	Sherman st., 15 ft. e. of w. of Jos. Campau to 2 ft. e. of e. of same			57					
Feb. to March 13	St. Aubin ave., 29 ft. s. of N. Boulevard to 27 ft n. of s. of Clay ave					1,327			
September 23	St. Clair ave., 41 ft. s. of n. of Jefferson to 602 ft. s. of s of same		645						
August 7	St. Joseph st., w. line to 184 ft. e. of e. of Collins			226					
June 3	St. Paul ave., 20 ft w. of e. of Iroquois to 20 ft. w. of e. of Burns			442					
September 28	Stanley ave., 25 ft. w. of e. of Humboldt to 2 ft. e. of e. of Eighteenth			319					
May 17	State st., alley s. of e. line of Griswold to 5 ft. e. of w. of alley w. of Woodward				132				
September 28	Stephens ave., 26 ft. n. of s. of Gratiot to 366 ft. n. of n. of same			422					
June 25	Sullivan ave., 12 ft. n. of n. of Buchanan to 463 ft. n. of n. of same			451					
July 12	Taylor ave., 2 ft. w. of e. of Hamilton to w. line of Woodward			2,605					
May 16	Thirteenth st., 5 ft. s. of n. of alley s. of Porter 13 ft n. of s. of Porter		110						
December 3	" 25 ft. n. of s. of Harper to 210 ft. n. of n. of same			242					
June 6	Tonti st., 34 ft. w. of e. of Parker 15 ft. w. of e. of Maxwell			212					
April 25	Trumbull ave., 21 ft. s. of n. of Fort to 9 ft. n. of s. of alley s. of Abbott				967				
"	" 24 ft. s. of n. of Abbott to 20 ft. n. of s. of Michigan				1,617				
January 30	Twelfth st., crossing Porter				90				

PIPE CONSTRUCTION, 1895.—CONTINUED.

DATE.	LOCATION.	DIAMETER IN INCHES.							
		3	4	6	8	10	12	24	42
June 21	Twenty-first st., s. to n. line of Porter	......	......	50	......	......	......	......	......
July 26	Twenty-sixth st., 24 ft. n. of s. of Brown to 38 ft n. of s. of Grand River	......	......	1,646	......	......	......	......	......
August 12	Twenty-fifth st., 64 ft. s. of s. of Hudson to 125 ft. s. of same	......	......	61	......	......	......	......	......
April 19	Warren ave., 35 ft e. of w. of Fourteenth to 7 ft. e. of e. of alley e of	......	......	215	......	......	......	......	......
June 11	" e. line of Mt. Elliott to 178 ft. e. of e. of same	......	......	178	......	......	......	......	......
July 21	" 17 ft. e. of w. of Detloff ct. to 63 ft. e. of same	......	......	86	......	......	......	......	......
May 28	Waterloo, crossing w. side of Mt. Elliott	......	......	......	16	......	......	......	......
May 17	Woodward ave., alley w. of 8 ft. s. of n. of alley s. of State to 24 ft. n. of s. of Clifford	......	......	......	1,062	......	......	......	......
September 16	" crossing n. s. of Clifford	......	......	25	......	......	......	......	......
" 19	" alley w. of Congress to 2 ft. s. of s. of alley s. of Fort	......	......	......	210	......	......	......	......
October 21	" alley w. of 8 ft. n. of s. of alley s. of Larned to 21 ft. s. of n. of Larned	......	......	......	120	......	......	......	......
June 6	Willis ave., 162 ft. e. of e. of Collins to w. line of Moran	......	......	518	......	......	......	......	......

To this report I again append the number of hydrants and reservoirs added to the pipeage. The following is as reported by Mr. James F. Tryon, Secretary of the Fire Department:

Hydrants 116, reservoirs 21, making the total number now in use, 2,594 hydrants and 541 reservoirs.

PIPEAGE OF THE CITY OF DETROIT,

JANUARY, 1896.

ALPHABETED BY STREETS, SHOWING THE SIZE OF IRON PIPE IN USE.

LOCATION.	DIAM. INCHES.
A st., e. from Scotten 78 ft	4
" Hubbard to Vinewood	4
Aberle ave., e. from Russell 349 ft	4
Abbott st., Tenth to Cass	24
" w. from Third 20 ft	6
" alley s. of, crossing Sixth	6
" alley s. of, 196 ft. e. of e. of Twelfth to Cass	4
Adair st., the river to 10 ft. n. of s. of Jefferson	6
" 10 ft. n. of s. to 29 ft. n. of s. of Jefferson	4
Adams ave., John R. to Randolph	6
" Witherell to Hastings	4
" alley s. of Cass to 240 ft. e. of Clifford	4
" alley s. of, John R. to Randolph	4
Adelaide st., 30 ft. e. of w. of Woodward to 22 ft. e. of w. of Brush	8
" 22 ft. e. of w. of Brush to 24 ft. e. of w. of Beaubien	10
" 24 ft. e. of w. of Beaubien to Orleans	4
" Orleans to 11 ft. e. of e. of same	18
" 11 ft. e. of e. of Orleans to Gratiot	10
" crossing Gratiot	8
Adele st., 23 ft. w. of e. of Chene to 8 ft. w. of w	6
Agnes ave., E. Boulevard to Field	4
" Baldwin to Seyburn	6
" 21 ft. w. of e. of Seminole to 20 ft. w. of e. of Iroquois	8
Albert st., Hammond to Wesson	6
Alexandrine ave., Grand River ave. main, to alley w. of Commonwealth	6
" alley w. of Commonwealth to alley w. of Trumbull	4
" alley w. of Trumbull to Seventh	6
" Seventh to Sixth	4
" Greenwood to 150 ft. w. of Fourth	4
" 150 ft. w. of Fourth to Fourth	3
" Third to Cass	4
" Cass to Woodward	6
" Woodward to John R	4
" John R. to 143 ft. w. of w. of Brush (center of st.)	6
" 143 ft. w. of, to Brush (center of street)	4
" 143 ft. w. of, to 34 ft. e. of e. of Brush (south lawn)	6
" 34 ft. e. of e. of Brush to Beaubien	4
" Beaubien to 15 ft. w. of w. of St. Antoine	3

LOCATION.	DIAM. INCHES.
Alexandrine ave., 15 ft. w. of w. of St. Antoine to 20 ft. w. of e. of same	4
" 20 ft. w. of e. of St. Antoine to Russell	6
" Russell to alley w. of Dubois	4
" alley w. of Dubois to Chene, w. line	3
" w. line of Chene to w. line of Grandy	4
" crossing Grandy	3
" McDougall to alley e. of	6
" alley e. of McDougall to 367 ft. e. of e. of Moran	4
Alfred st., from 30 ft. e. of w. of Woodward 16 ft. w. of e. of John R.	8
" from 16 ft. w. of e. of John R. to e. line of Brush	6
" from e. line of Brush to Russell	4
" Russell to Orleans	3
" Orleans to Dubois	4
Alger ave., 16 in. main to e. line of Woodward	6
" e. from Woodward 514 ft.	4
" from 514 ft. e. of Woodward to 108 ft. e. of e. of John R.	6
" Russell to 443 ft. e. of Greeley	6
Amherst st., 23 ft. e. of w. of Cavalry to 314 ft. w. of Junction	6
" 314 ft. w. of w, to Junction	4
Amsterdam st., 44 ft. w. of e. of Second to 44 ft. w. of w. of Cass	6
" 44 ft. w. of w, to e. line of Cass	4
" e. line of Cass to w. line of Woodward	6
" crossing Woodward, west side	4
Annexation st., Junction to 540 ft. e. of e. of same	4
Anthon st., 260 ft. w. of Campbell to 360 ft. w. of Junction	6
" 360 ft. w. of w. to 30 ft. w. of e. of Junction	4
Antietam st., Rivard to 22 ft. w. of w. of McDougall	4
" crossing Jos. Campau	6
Antoinette st., crossing Eighteenth, east side	4
" e. line of Eighteenth to 28 ft. e. of w. of Stanton	6
" Fifteenth to 223 ft. w. of Fourteenth	6
" 223 ft. w. of, to Fourteenth	4
" Fourteenth 138 ft. w. of Wabash	6
" 138 ft. w. of, to Wabash	4
" 193 ft. w. of, to Twelfth	4
" 43 ft. w. of e. to e. line of Second	4
" e. line of Second to Cass	6
Arlington pl., Cass to Woodward	4
Arndt st., Gratiot to 6 ft. w. of w. of Elmwood	6
" 6 ft. w. of w. of Elmwood to Mt. Elliott	4
Artillery ave., n. from River st. to Battery	6
" crossing Fort	6
" 78 ft. s. of s. to n. line of Lafayette	6
" 477 ft. s. of s. of main in Dix	8
Ash st., Vinewood to Twenty-seventh	4
" Twenty-fourth to e. line of Tillman	4
" Maybury to 250 ft. e. of e.	4
" 250 ft. e. of e. of Maybury to Sullivan	8
" Sullivan to Humboldt	4
" Humboldt to 166 ft. e. of e. of same	3
" 166 ft. e. of e. of Humboldt to e. line of Eighteenth	4
" e. line of Eighteenth st. to Seventeenth, w. line	8
" w. line of Seventeenth to e. line of Sixteenth	4
" crossing Fifteenth	4
" 148 ft. w. of w. to Wabash	4
" alley e. of Wabash to Twelfth	6

LOCATION.	DIAM. INCHES.
st., Twelfth to Harrison	4
" National to alley w. of Trumbull	6
" alley e. of Trumbull to Grand River	4
inson ave., 16 in. main to 21 ft. w. of Woodward	6
water st., Shelby to 8 ft. w. of w. of Brush	6
" 8 ft. w. of w. of Brush to 149 ft. e. of e. of Rivard	4
" 149 ft. e. of Rivard to 33 ft. w. of e. of McDougall	6
" alley s. of, alley w. of Bates to Randolph	4
udrain st. (in line of), Clippert to Michigan Brass & Iron Works, 1,808 ft. (outside of city limits)	4
Aurelia st., w. line of Thirteenth to Twelfth	4
Avery ave., 21 ft. n. of s. of Willis to 345 ft. n. of Kirby	6
" s. from Piquette 104 ft	6
" alley w. of, Alexandrine to alley s. of Willis	4
" alley w. of, Lysander to Lombard terrace	6
B st., 313 ft. w. of, to Vinewood	4
Bagg st., Fifteenth to Woodward	24
" crossing Greenwood on e. side	4
" e. line of Greenwood to Fifth	3
Bagley ave., Grand River to Park	8
" alley e. of, Cass to alley s. of Park	4
Baker st., Scotten to Hubbard	4
" crossing e. side of Vinewood	6
" Vinewood to Twenty-fifth	4
" crossing Twenty-fifth, e. side	6
" Twenty-fifth to Twenty-fourth	4
" Twenty-fourth to Seventh	8
" Eighth to Seventh	4
" alley s. of, Fourteenth to Wabash	4
" alley s. of, Tenth to Eighth	3
" alley s. of, Eighth to alley w. of Fourth	4
Baldwin ave., Jefferson to Waterloo	6
" from Mack s. 267 ft	6
" Mack to Gratiot	10
" Gratiot to Harper	8
Baltimore ave., w. from Sullivan 297 ft	4
" from Lincoln to w. line of Greenwood	6
" Greenwood to Woodward	4
" Woodward to w. line of Brush	3
" crossing Brush w. side 41 ft	6
" alley s. of, Greenwood to Forsyth	6
Bancroft ave., 16 in. main, to w. line of Woodward	6
Bates st., Atwater to Farmer	6
" from Congress to Champlain	30
" alley e. of, n. line of Atwater to alley s. of Woodbridge	3
Battery st., Artillery to Dragoon	6
Beacon st., crossing Brush, e. side	6
" Brush to 211 ft. e. of St. Antoine	4
Beals ave., s. from Mack 1,628 ft	6
Beaman st., Crane to alley w. of	4
Beaubien st., from Atwater to Champlain, s. line	6
" s. line Champlain to 4 ft. s. of n. of alley n. of	8
" alley n. of Champlain to Clinton	6
" Clinton to s. line of Gratiot	4
" crossing Gratiot, s. side	6
" Gratiot to 14 ft. s. of n. line Madison	8
" Madison to 23 ft. s. of n. line of Elizabeth	4

LOCATION.	DIAM. INCHES.
Beaubien st. 31 ft. s. of n. line of Elizabeth to 28 ft. n. of s. line of Columbia	12
" 28 ft. n. of s. of Columbia to 16 ft. n. of s. of Adelaide	10
" crossing Adelaide, n. side	6
" n. line Adelaide to Watson	4
" Watson to Harper	10
" Harper to s. line of Boulevard	6
" crossing Boulevard, s. side	10
" 47 ft. s. of n. of Boulevard to Custer	6
Beaufait ave., n. from Jefferson 585 ft	6
" 585 ft. n. of Jefferson to 225 ft. s. of Champlain	4
" 225 ft. s. of Champlain to 263 ft. n. of Kercheval	6
" s. line of Mack to 190 ft. n. of n. of Forest	6
" crossing N. Boulevard	6
Beaver st., Vinewood to Twenty-seventh	4
Beech st., Seventh to First	4
Bellevue ave., Jefferson to 281 ft. n. of n. of Stuart	6
" crossing Gratiot	6
" Gratiot to 25 ft. s. of s. of Frederick	4
" 25 ft. s. of s. of Frederick 100 ft. n. of n. of same	6
" crossing N. Boulevard	8
Belmont ave., 16-in. main to e. line Woodward	6
" 99 ft. w. of w. of to Oakland	6
Belvidere ave., crossing Jefferson, n. side	10
" n. from Jefferson to 285 ft. n. of n. line	6
" 30 ft. s. of n. of St. Paul to 535 ft. n. of Lorman	6
" crossing s. side of Mack to 177 ft. s. of same	6
Benton st., Brush to 8 ft. w. of e. line of Beaubien	8
" from Beaubien to Russell	4
Berlin st., Gratiot to Jos. Campau ave	3
" crossing Jos. Campau ave	4
" Jos. Campau to alley w. of McDougall	6
" alley e. of McDougall to Elmwood	8
" crossing Elmwood	4
" Ellery to Mt. Elliott	4
Bethune ave., Hamilton Boulevard to Woodward	6
Biddle st., Vinewood to Twenty-seventh	4
Blaine ave., 16-in. main to w. line Woodward	6
" w. from Woodward 1,616 ft	4
Boone st., E. Boulevard 81 ft. e. of e. of same	6
" 314 ft. w. of Collins to w. line of same	4
" 11 ft. e. of e. of Collins to 284 ft. w. of w. of Moran	6
" 284 ft. w. of, to Moran	4
Boulevard, between Fort and Myrtle, see W. Boulevard.	
" " Twenty-seventh and Hubbard, see Myrtle Boulev'd.	
" " Myrtle and N. Boulevard, see Hubbard Boulevard.	
" " Hubbard Boulevard and McDougall, see N. Boulevard.	
" " N. Boulevard and Hendrie, see McDougall Boulev'd.	
" " McDougall and Frontenac, see Hendrie Boulevard	
" " Hendrie and Jefferson, see Frontenac Boulevard.	
Bowen ave., Jefferson to 50 ft. s. of Chapoton	6
Bradley st., w. from Crane 211 ft	4
Brady st., Woodward to 3 ft. w. of w. of Brush	6
" 3 ft. w. of w. to 18 ft. w. of e. of Beaubien	8
" Beaubien to Russell	4

LOCATION.	DIAM. INCHES.
ainard st., Trumbull to e. line of Seventh	6
" e. line of Seventh to Sixth	4
" Greenwood to alley w. of Fourth	8
" alley w. of, to 16 ft. w. of e. of Fourth	4
" 16 ft. w. of e. of Fourth to 17 ft. e. of w. of Third	6
" Third to Cass	4
andon pl., 114 ft. w. of w. of to Moran	6
andon ave. (west), Campbell to Junction	6
" " Junction to Hubbard	4
atshaw st., 15 ft. w. of e. of Fourth to 28 ft. e. of w. of Third	10
reckenridge st., w. from Humboldt 74 ft	4
" Humboldt to Eighteenth	6
" Eighteenth to 148 ft. w. of Sixteenth	4
" 148 ft. w. of Sixteenth to Sixteenth	6
" Fifteenth to 140 ft. w. of Fourteenth	6
" 140 ft. w. of, to Fourteenth	4
Brevoort pl., Twenty-second to alley e. of	6
" Nineteenth to alley w. of Eighteenth	4
Brewster st., crossing e. side of Brush	6
" e. line of Brush to Russell	4
" Riopelle to Gratiot	4
Brinket st., Crane to Hibbard	6
Bristol pl., Twenty-second to Twenty-first	4
Brown pl., 25 ft. w. of e. of Twenty-sixth, e. 146 ft	6
Bruce st., 2 ft. w. of alley w. of, to Crane	4
Brush st., Atwater to Jefferson	6
" crossing Jefferson	8
" Jefferson to Congress	4
" Congress to Gratiot	8
" Gratiot to 28 ft. n. of s. of Madison	4
" Madison to 10 ft. s. of n. of Elizabeth	8
" Elizabeth to s. line of Adelaide	4
" crossing s. side of Adelaide	6
" 15 ft. n. of s. of Adelaide to 21 ft. s. of n. of Edmund	10
" Edmund to Watson	24
" Watson to Benton	6
" 15 ft. n. of s. of Benton to 28 ft. s. of n. of Rowena	8
" Brady to 3 ft. n. of s. of Alexandrine	8
" 3 ft. n. of s. of Alexandrine to 230 ft. n. of Milwaukee	6
" 230 ft. n. of Milwaukee to 24-in. main in N. Boulevard	8
" crossing Palmer, both sides	4
" Horton to Hamlin	4
" crossing Chandler	6
Bryant st., e. from Wabash 125 ft	6
" 125 ft. e. of Wabash to Twelfth	4
Buchanan st., Livernois to Vinewood	16
" Vinewood to Grand River	30
" Twenty-eighth to Scotten	4
" Twenty-fourth to Twenty-third	4
" Williams to e. line of Maybury	4
" e. line of Maybury to 75 ft. e. of Sullivan	3
" 387 ft. w. of Humboldt to Eighteenth	4
" 169 ft. w. of, to Seventeenth	4
" Fifteenth to Wabash	4
" alley s. of, Joe to Howell	6
Burns ave., Jefferson from 42-in. main n. 435 ft	10
" 42-in. main in Champlain to n. line of St. Paul	12

PIPE CONSTRUCTION, 1895.

The following is a detail list of the total lines laid, giving locations, size of pipe and length of same:

DATE.	LOCATION.	DIAMETER IN INCHES.							
		3	4	6	8	10	12	24	42
August 7	Adele st., 23 ft. w. of e. of Chene to 8 ft. w. of w. of same			56					
June 1	Agnes ave., 21 ft. w. of e. of Seminole to 20 ft. w. of e. of Iroquois				443				
November 8	Alfred st., 28 ft. e. of w. of Woodward to 16 ft. w. of e. of John R.				733				
"	" 16 ft. w. of e. of John R to 3 ft. e. of w. of Brush			604					
July 23	Alger ave., 66 ft. w. of w. of John R to 108 ft. e. of e. of same			235					
September 19	Antietam st., crossing Jos. Campau			67					
July 25	Baldwin ave., s. line of Mack to 269 ft. s. of same.			269					
November 14	Beaubien st., n. line of Champlain to 4 ft. s. of n. of alley s. of Monroe				152				
June 27	Bellevue ave., 25 ft. s. of s. of Frederick to 100 ft. n. of n. of same			184					
June 14	Belvidere ave., 4 ft. s. of s. of Mack to 177 ft. s. of same			173					
September 26	" 57 ft. n. of n. of Kercheval to 67 ft. s. of Lorman			530					
June 8	Boone st., 11 ft. e. of e. of Collins to 280 ft. w. of w. of Moran			390					
July 30	" 8 ft. e. of e. of McDougall Boulevard to 88 ft. e. of same			80					
July 26	Brown pl., 25 ft. w. of e. of Twenty-sixth to 146 ft. e. of e. of same			171					
May 3	Burlingame ave., 35 ft. w. of e. of Woodward to 1205 ft. w. of w. of same			1,260					
May 29	Burns ave., 51 ft. s. of n. of Jefferson to 300 ft. n. of same					359			
June	" 205 ft. n. of Jefferson to 2 ft. n. of St. Paul						1,417		
August 12	Burrell pl., 26 ft. w. of e. of Maybury to 213 ft. e. of Sullivan			724					
May 4	Cadillac sq., 283 ft. w. of Bates to 120 ft. e. of same		463						
October 3	Cameron ave., 26 ft. s. of n. to 99 ft. n. of n. of Haigh			123					
September 19	Catherine st., crossing Jos. Campau			12	58				
June 19	Cavalry ave., 36 ft. s. of n of Fort to 18 ft. s. of n. of Celeron			432					
"	Celeron ave. 17 ft. w. of e. of Cavalry to 231 ft. e. of same			248					
November 8	Chase st., 23 ft. n. of s. of River st. to 430 ft. s. of same		477						
May 15	Champlain st., Chene to 19 ft. e. of w. of Crane								11,364
"	" Jefferson ave. connections				318		91		
September 19	Chestnut st., crossing Jos. Campau			70					
September 30	Church st., 178 ft. w. of w. of Eleventh to 27 ft. w. of e. of same			211					
June 3	" 27 ft. w. of e. of Eleventh to 78 ft. w. of w. of Tenth			305					
February 9	Commonwealth ave., 440 ft. s. of Piquette to 671 ft. s. of same			231					
June 12	Conger st., 21 ft. e. of w. of Baldwin to 160 ft w. of Van Dyke			321					
May 15	Crane ave., 22 ft. s. of n. of Jefferson to 42-inch Main							28	
July 19	Eastern ave., 25 ft. w. of e. of Twenty-sixth to 176 ft. e. of e. of same			201					
December 24	Eighth st., 28 ft. s. of n. of River st. to 12 ft. n. of n. of Abbott				1,587				

May 8	Eighth st., 12 ft. n. of n. of Abbott to 30 ft. n. of s. of Michigan				1,595				
"	" crossing n. side of Michigan			47					
September 26	" n. line of Michigan to 3 ft. n. of Orchard			313					
May 16	Eighteenth-and-a-half st., 504 ft. s. of River to 677 ft. s. of same	173							
"	" " 677 ft. s. of River to 857 ft. s. of same		180						
June 3	Ellery st., 25 ft. n. of s. of Pulford to 25 ft. n. of s. of Zender			298					
December 17, '94	Fort st., 20 ft. w. of e. of Tenth to 21 ft. w. of e. of Seventh						1,229		
September 27	" alley s. of 16 ft. w. of e. of Griswold to alley w. of Woodward				109				
November 28	Frederick st., 30 ft. w. of e. of Bellevue to 22 ft. e. of w. of Concord			376					
"	Frontenac Boulevard, 42-inch Main to 8 ft. n. of Champlain						54		
January 15	" " 8 ft. s. of n. of St. Paul to s. line of Waterloo, (e. side)		1,553						
"	" " s. line of Waterloo to 22 ft. s. of n. of Mack, (e. side)			2,719					
" 12	" " n. line of Gratiot to 11 ft. n. of n. of Farnsworth w.			780					
"	" " 4 ft. s. of n. of Farnsworth to 13 ft. n. of s. of Ferry, (w. side)			1,074					
"	" " 7 ft. n. of s. of Ferry to 13 ft. n. of s. of Hendrie, (w. side)			789					
Feb. and April 23	" " n. line of Mack to Gratiot, (e. side)					3,451			
June 17	" " 28 ft. n. of s. of Mack to n. line of same					43			
December 18	Greeley st., 18 ft. s. of n. of Alger to 10 ft. s. of n. of Gillet			540					
" 23	Gillet st., 10 ft. e. of w. of Greeley to 336 ft. e. of same			366					
June 27	Haigh ave., 158 ft. e. of Woodward to 668 ft. e. of same			510					
October 3	" 22 ft w. of e. of Russell to 22 ft. w. of e. of Cameron			656					
April 29	Hamilton ave., 689 ft. n. of n. of Canfield to 3 ft. s. of s. of Warren			941					
November 26	Harper ave., 29 ft. w. of e. of Thirteenth to 154 ft. e. of same			183					
May 23	Hastings st., 158 ft. s. of s. of Palmer to s. line of Medbury			972					
October 14	Hazel st., 25 ft. w. of e. of Harrison to 25 ft. w. of e. of National			284					
May 27	Hendrie ave., crossing Hastings			58					
June 13	" 24 ft. w. of e. of Van Dyke to w. line of Maxwell			566					
October 3	" alley s. of 378 ft. w. of Rivard to 16 ft. w. of e. of same			413					
February 2	Hendrie Boulevard, e. line of Collins to 32 ft w. of e. of McDougall Boulevard			431					
"	" 20 ft. w. of e. of Mt. Elliott to 12 ft. w. of e. of Collins					1,970			
January 1	" 12 ft. e. of w. of Frontenac to 20 ft. w. of e. of Mt. Elliott				2,545				
August 1	High st., 1 ft. e. of e. of Beaubien to 3 ft. w. of e. of St. Antoine			483					
February 25	Hubbard Boulevard, n. line of McGraw to 10 ft. n. of s. of Scovel		1,960						
September 19	Hudson ave., 18 ft. w. of e. of Fourteenth to 36 ft. e. of w. of Wabash			368					
May 11	Hussar st., 25 ft. w. of e. of Military to 204 ft. e. of same			229					
August 5	Illinois st., 4 ft. w. of w. of Collins to 4 ft. e. of same			48					
June 7	Iroquois ave., 6 ft. s. of Champlain to 21 ft. s. of n. of Agnes				702				
"	" 21 ft. s. of n. of Agnes to 2 ft. n. of n. of St. Paul			712					
June 10	" alley e. of 5 ft. n. of s. of alley n. of Jefferson to 115 ft. n. of same		130						
September 19	Jay st., crossing Jos. Campau			70					
May 15	Jefferson ave., 19 ft. e. of w. of Crane to Pumping Works grounds								3,383
June 10 and Aug.	" alley n. of 15 ft. w. of e. of Parker to 5 ft. w. of e. of alley e. of Iroquois		1,224						
January 17	Josephine ave., e. line of Woodward to 1,905 ft. e. of same			1,906					
September 19	Jos. Campau ave., 25 ft. n. of s. of Catherine to 20 ft. n. of s. of Jay				1,400				
May 23	Kercheval ave., 24 ft. e. of w. of Mt. Elliott to 97 ft. e. of e. of Beaufait				916				
May 20	King ave., 3 ft. e. of e. of Woodward to 871 ft. e. of e. of Brush			2,244					
June 16	Kirby ave., 24 ft. w. of e. of Maybury to 219 ft. e. of Sullivan			726					

PIPE CONSTRUCTION, 1895.—CONTINUED.

DATE.	LOCATION.	DIAMETER IN INCHES.							
		3	4	6	8	10	12	24	42
August 8	Kirby ave., 23 ft. w. of e. of Chene to 154 ft. e. of e. of same			177					
March 18	" 85 ft. w. of, to w. line of Moran			85					
May 4	Lafayette ave., e. line of Twenty-third to 1 ft. w. of w. of Twenty-second		314						
October 24	Larned st., alley s. of 2 ft. e. of e. of Griswold to 8 ft. w. of e. of alley w. of Woodward				91				
May 4	Lawrence ave., w. line of Woodward to 1212 w. of w. of same			1,212					
July 18	Leib st., 2 ft. n. of n. of Champlain to 18 ft. s. of n. of Monroe				327				
August 6	Leland st., w. line of Collins to 6 ft. e. of e. of same			46					
October 2	Lemay ave., 21 ft. s. of n. of Jefferson to 584 ft. n. of n. of same			605					
" 3	Lincoln ave., alley w. of s. line of Brainard to s. line of Calumet			1,840					
August 9	Lyman st., 4 ft. w. of w. of Chene to 23 ft. w. of e. of same			47					
Feb. 2 and March 8	McDougall Boulevard, 22 ft. n. of s. of Hendrie Boulevard to 29 ft. s. of n. of Griffin			2,790					
June 11	Mack ave., 30 ft. w. of w. of Rolf pl. to 16 ft. w. of e. of same				60				
"	Marston court, 125 ft. w. of w. of John R to 251 ft. e. of e. of same			436					
September 21	" 243 ft. w. of w. of Oakland to 27 ft. e. of w. of same			270					
June 18	Maxwell ave., alley n. of Jefferson to n. line of Champlain		386						
June 11	" 18 ft. s. of n. of Champlain to 16 ft. n. of s. of Tonti			546					
July and August 1	Maybury ave., 170 ft. n. of n. of Warren to 88 ft. s. of s. of Grand River				1,863				
June 1	Meldrum ave., crossing Kercheval			80					
September 16	" 168 ft. s. of s. of Forest to 30 ft. n. of s. of same			196					
August 1	Merrick ave., 27 ft. w. of e. of Maybury to 212 ft. e. of e. of Sullivan			724					
Feb. 15 and March	" 25 ft. w. of e. of Seventh to 20 ft. w. of e. of Greenwood			720					
September 7	Milwaukee ave., 4 ft. w. of w. of Eighteenth to the w. line of Sixteenth			790					
July 18	Monroe ave., 15 ft. e. of w. of Leib to 26 ft. e. of w. of Mt. Elliott			557					
November 14	" alley s. of 23 ft. e. of w. of Beaubien to 261 ft. e. of e. of same				298				
April 30	Montcalm st., crossing e. side of Clifford			29					
April 24	" crossing Park			60					
August 8	" e. line of Beaubien to 23 ft. e. of w. of St. Antoine			487					
May 1	Montclair ave.. 844 ft. n. of n. of Mack to 6 ft. s. of s. of Canfield			800					
July 27	Moore pl., 25 ft. w. of e. of Twenty-sixth to 169 ft. e. of e. of same			194					
May 23	Newport ave., 70 ft. s. of n. of Jefferson to 397 ft. n. of n. of same			467					
June 24	Nineteenth st., s. to n. line of Porter, (s. side)			50					
November 23	North Boulevard, 330 ft. w. of w. of Grand River to 13 ft. e. of w.		345						
July 10	" " 595 ft. e. of e. of Grand River to 639 ft. e. of e.of same, (n. side)		44						
May 28	" " 1108 ft. w. of w. of Sullivan to 100 ft. w. of same, (n. side)		108						
July 8	" " 33 ft. w. of e. of Sullivan to 146 ft. e. of same, (s. side)		179						
May 9	" " 15 ft. w. of e. curb of Second to 69 ft. e. of same, (s. side)		84						

May 7	Park ave., 514 ft. n. of n. of Canfield to 124 ft. n. of n. of Warren								
April 22	Park st., 17 ft. n. of s. of Columbia to 20 ft n. of s. of Bagg								
"	" 4 ft. s. of n. of Bagg to 25 ft. n. of s. of Peterboro			813					
May 15	Park View ave., s. line of Jefferson to 42-in main				44				
July 8	Parker ave., 6 ft. n. of s. of alley n. of Jefferson to 11 ft. n. of s. of Tonti			975					
May 27	Palmer ave., crossing Hastings			58					
September 14	" 190 ft. e. of e. of Moran to 300 ft. e. of e. of same			110					
July 10	Pennsylvania ave., 70 ft. s. of s. of Kercheval to 410 ft. n. of n. of same			560					
July 12	Perrien Park, 25 ft w. of e. of Chene to 410 ft. e. of e. of same		450						
January 2	Piquette ave., 29 ft. w. of e. of Fifth to w. line of alley			154					
October 10	Poplar st. 194 ft. w. of w. of Humboldt to 23 ft. w. of e. of same			230					
June 21	Porter st., 20 ft. w. of e. of Twentieth to 22 ft. e. of w. of Twenty-second				807				
May 27	" 30 ft. w. of e. of Fourteenth to 20 ft. w. of e. of Twentieth					1,950			
Dec. to Jan. 25	" 31 ft. w. of e. of Fourteenth to 9 ft. w. of w. of Tenth						2,108		
May 16	" alley s. of 8 ft. w. of e. of Thirteenth to 23 ft. e. of e. of same		31						
August 17	Putnam ave., 5 ft. e. of w. of alley e. of Second to w. line of Cass (s. side)			425					
September 24	" 34 ft. e. of w. of Cass to 318 ft. w. of same			330					
"	Rivard st., 33 ft. n. of s. of Harper to 126 ft n. of n. of same			172					
November 4	River Road, 55 ft. w. of w. of Dearborn to 49 ft. w. of Exposition ave.			2,346					
" 26	" 22 ft. e. of w. of Pleasant ave. to 74 ft. e. of e. of Swain			410					
June 11	Rolf Place, 22 ft. s. of n. of Mack to 521 ft. n. of n. of same			543					
August 15	Rollin st., 41 ft. w. of e. of Wesson to 336 ft. e. of e. of same			377					
May 23 and June 26	Romeyn st., 26 ft. w. of e. of Campbell to 23 ft. e. of w. of Cavalry			589					
November 23	Second ave., alley w. of 16 ft. s. of n. of Putnam to 28 ft. n. of s. of Merrick			399					
August 10	" alley e. of 28 ft. n. of s. of Warren to 16 ft. n. of s. of Putnam			417					
May 16 and June	Seminole ave., alley e. of 6 ft. n. of s. of alley n. of Jefferson to n. line of Champlain		278						
June 1	" alley e. of n. line of Champlain to 21 ft. s. of n. of Agnes			684					
June 7	" 21 ft. s. of n. of Agnes to the n. line of St. Paul				712				
July 22	Scovel pl., 25 ft. w. of e. of Twenty-sixth to 208 feet e. of e. of same			228					
September 17	Sherman st., 15 ft. e. of w. of Jos. Campau to 2 ft. e. of e. of same			57					
Feb. to March 18	St. Aubin ave., 29 ft. s. of N. Boulevard to 27 ft n. of s. of Clay ave					1,327			
September 23	St. Clair ave.. 41 ft. s. of n. of Jefferson to 602 ft. s. of s of same		645						
August 7	St. Joseph st., w. line to 184 ft. e. of e. of Collins			228					
June 5	St. Paul ave., 20 ft w. of e. of Iroqouis to 20 ft. w. of e. of Burns			442					
September 28	Stanley ave., 25 ft. w. of e. of Humboldt to 2 ft. e. of e. of Eighteenth			319					
May 17	State st., alley s. of e. line of Griswold to 5 ft. e. of w. of alley w. of Woodward				132				
September 28	Stephens ave., 26 ft. n. of s. of Gratiot to 366 ft. n. of n. of same			422					
June 25	Sullivan ave., 12 ft. n. of n. of Buchanan to 463 ft. n. of n. of same			451					
July 12	Taylor ave., 2 ft. w. of e. of Hamilton to w. line of Woodward			2,605					
May 16	Thirteenth st., 5 ft. s. of n. of alley s. of Porter 18 ft n. of s. of Porter		110						
December 3	" 25 ft. n. of s. of Harper to 210 ft. n. of n. of same			243					
June 6	Tonti st., 34 ft. w. of e. of Parker 15 ft. w. of e. of Maxwell			212					
April 23	Trumbull ave., 21 ft. s. of n. of Fort to 9 ft. n. of s. of alley s. of Abbott				857				
"	" 24 ft. s. of n. of Abbott to 20 ft. n. of s. of Michigan				1,817				
January 10	Twelfth st., crossing Porter				60				

LOCATION.	DIAM. INCHES.
Dequindre st., Woodbridge to Jefferson	6
" w. side Jay to Waterloo	4
" e. side Waterloo to Gratiot	4
" s. from Adelaide 206 ft	4
" Alfred to Pierce	4
" Canfield to Willis	4
" alley e. of, s. from Ferry 266 ft	4
Detloff court, crossing Hancock, n. side	4
" Hancock to 270 ft. n. of n. of same	3
Devereaux st., Thirty-first to Thirtieth	6
Dillon ave., n. from Holden 687 ft	6
Division st., crossing Brush, e. side	6
" e. line of Brush to St. Aubin	4
Dix ave., Artillery to Twenty-fourth	10
" (n. side), crossing W. Boulevard 130 ft	6
" crossing Twenty-third	6
Dragoon ave., n. from River st. 563 ft	6
" Hussar to n. line of Dix	6
Driggs ave., Campbell crossing w. side	6
" Campbell to Junction	4
Dry Dock st., Swain to Lady's lane	4
Dubois st., Atwater to Clinton	6
" Clinton to Hunt	8
" Hunt to n. line of Leland	6
" n. line of Leland to s. line of Canfield	3
" Canfield, crossing s. side 40 ft	6
" 40 ft. n. of s. of Canfield to 25 ft. n. of s. of Farnsworth	16
" Farnsworth, crossing n. side from 16-in. main to n. line 48 ft.	8
" n. line of Farnsworth to 188 ft. n. of Frederick	4
" 188 ft. n. of Frederick to Ferry	6
" Ferry to Hendrie	4
" Hendrie to 100 ft. s. of Medbury	6
" 100 ft. s. of, Medbury to 20 ft. s. of Harper	4
" 20 ft. s. of Harper to 22 ft. n. of s. of Trombley	8
" crossing N. Boulevard	8
Duffield st., Cass to Woodward	4
Dumontier st., e. from Crane 297 ft	4
" 297 ft. e. of to 336 ft. e. of Crane	6
Dunn st., Wesson to Campbell	8
Durand st., 29 ft. w. of e. of Van Dyke to 372 ft. w. of w. of same	6
E st., Hubbard to Vinewood	4
" crossing W. Boulevard from 5 ft. e. of w. to 2 ft. w. of e	6
" e. line of W. Boulevard to Twenty-sixth	4
" Twenty-sixth to Twenty-fifth	6
Eastern pl., 25 ft. w. of e. of Twenty-sixth, e. 176 ft	6
Edison ave., 16-in. main in Woodward to w. line of same	6
Edmund pl., Woodward to Brush	24
Eighth st., 28 ft. s. of n. of River st. to 30 ft. n. of s. of Michigan	8
" 30 ft. n. of s. of Michigan to 3 ft. n. of n. of Orchard	6
" 3 ft. n. of n. of Orchard to Cherry	4
" Grand River to Calumet	8
" crossing s. side of Calumet 40 ft	6
" Calumet to Lysander	4
Eighteenth st., Fort to s. line of Myrtle	6
" s. to n. line of Myrtle	8
" Myrtle to 50 ft. n. of Linden	6

LOCATION.	DIAM. INCHES.
hteenth st., 50 ft. n. of, to 370 ft. n. of Linden	3
" 370 ft. n. of, to 468 ft. n. of Linden	4
" 468 ft. n. of Linden to n. line of Buchanan	6
" n. line of Buchanan to s. line of Hancock	4
" crossing s. side of Hancock	6
" Grand River to N Boulevard (s. line)	6
" crossing N. Boulevard	8
" n. from N. Boulevard 228 ft	6
" alley w. of, Brevoort to Webster pl	4
" alley w. of, St. Clair to Wing pl	4
" alley w. of, Chipman to Johnson	4
Eighteenth-and-a-half st., 1,677 ft. s. of River st. s. 160 ft	4
" s. from River st. 677 ft	3
" River st. to Fort	4
Eleventh st., Leverette to Michigan	6
Eliot st., Woodward to 29 ft. w. of e. of John R	6
" John R. to Riopelle	4
Ellery st., Waterloo to Charlevoix	6
" Arndt to Berlin	6
" Heidelberg to Schneider pl	6
" s. line of Mack to Gratiot	6
" crossing Hendrie Boulevard	6
Ellery pl., Forest to Hancock	3
Elizabeth st., Grand River to Cass	8
" 22 ft. e. of w. of Park to 20 ft. e. of w. of Brush	8
" Brush to Beaubien	4
" (both sides), alley e. of Woodward to 177 ft. w. of Brush	4
" Beaubien to St. Antoine	12
" St. Antoine to Hastings	4
" alley s. of, 100 ft. w. of Cass to Woodward	4
" alley s. of, alley e. of Woodward to Witherell	3
" alley s. of, John R. to Randolph	4
Elm st., alley e. of Wabash to Harrison	4
" Harrison to National	6
" National to alley w. of Trumbull	4
" alley e. of Trumbull to Seventh	4
Elmwood ave., Jefferson to Monroe	4
" Monroe to Maple	6
" Waterloo to Hunt	4
" Hunt to Gratiot	6
Emmons st., McClellan to Pennsylvania	4
Endicott ave., crossing e. side of Woodward	4
" crossing w. side of John R	6
Englewood ave., crossing Woodward, e. side	6
" e. line of Woodward to w. line of Oakland	4
" e. from w. line of Oakland 30 ft	6
Erie pl., crossing w side of Moran 23 ft	6
Erskine st., Woodward to Russell	4
" Russell to 159 ft. w. of Riopelle	6
" 159 ft. w. of to Riopelle	4
" Dequindre to w. line of Chene	4
" w. line of Chene to Grandy	8
Euclid ave., 520 ft. w. of to Woodward	6
Exposition Grounds, s. from River st. 948 ft	4
F. st., 140 ft w. of to Vinewood	4
" crossing roadway of Vinewood 27 ft	6
Fairbanks st., e. from Scotten 364 ft	4

LOCATION.	DIAM. INCHES.
Farmer st., Bates to Gratiot	6
" 15 ft. s. of to 38 ft. n. of 30-in. main in Gratiot	8
Farnsworth st., Woodward to Rivard	6
" Rivard to Dubois	16
" crossing e. side of Dubois	6
" e. line of Dubois to Grandy	4
" Mitchell to McDougall	4
" crossing Collins	6
" Collins to Moran	3 & 4
" crossing e. side of Moran 29 ft	6
" crossing Mt. Elliott from w. line to 14 ft. w. of e. 51 ft.	6
" 162 ft. w. of to Concord	6
" Canton to Helen	4
" crossing Frontenac Boulevard	6
" alley s. of or first st. s. of, crossing w. side of Moran	6
Farrand st., e. from McClellan 513 ft	6
Ferdinand st., n. from River st. 975 ft	4
" 975 ft. n. of River st. to 493 ft. s. of. s. line of Fort	6
" 493 ft. s. of s. of to Fort	4
" Porter to 140 ft. n. of Christiancy	6
" 360 ft. s. of to 309 ft. n. of Dix	6
Ferry ave., Woodward to Russell	4
" Russell to St. Aubin	8
" St. Aubin to Mitchell	4
" 60 ft. w. of w. of Collins to w. line of same	6
" w. line of Collins to 82 ft. e. of e. of same	8
" 247 ft. w. of to Moran	4
" crossing e. side Moran	6
" crossing Mt. Elliott from 6-in. main to 4-in. main, 39 ft.	6
" 24 ft. e. of w. of to 222 ft. e. of e. of Helen	6
" crossing Frontenac Boulevard	8
" Townsend to Baldwin	6
" alley s. of 168 ft. w. of to Secor pl	4
" alley n. of from 20 ft. e. of w. of Hastings e. 408 ft	6
Field ave., Jefferson to 740 ft. n. of Waterloo	6
" 4 ft. s. of Mack to 177 ft. n. of Medbury	6
Fifth st., Congress to alley n. of	8
" alley s. of to alley n. of Lafayette	4
" Abbott to Cherry	6
" Cherry to Noble	4
" both sides of Elton and Crawford Parks	4
" Holden to 144 ft. s. of Piquette	4
" 144 ft. s. of to Piquette	6
Fifteenth st., Fort to north line of Grand River	6
" Bagg to Buchanan	24
" n. from Warren 348 ft	6
" Kirby to Harper	6
" crossing N. Boulevard	6
Finley st., 433 ft. w. of to Jos. Campau	4
First st., Front to Woodbridge	6
" Woodbridge to alley n. of Jefferson	8
" Jefferson to s. line of Congress	4
" crossing Congress	8
" n. line of Congress to Fort	4
" Fort to Grand River	6

LOCATION.	DIAM. INCHES.
st st., alley w. of alley s. of to Spencer	4
" alley w. of alley s. of to Prentiss	4
Fischer ave., Jefferson to 90 ft. n. of Beaman	6
" crossing Mack from 42-in. main to 8-in. main	8
" n. from Mack 1,483 ft	6
Florence st., Harper to Piquette	4
Florene st., Shipherd to Van Dyke	6
Flower st., crossing Forest s. to n. line	4
" n. from Forest 260 ft	3
" 260 ft. n. of Forest to Hancock	6
Forest ave., Fourteenth to alley w. of Wabash	6
" 2 ft. w. of w. of Wabash to 190 ft. w. of Twelfth	6
" 190 ft. w. of Twelfth to Avery	4
" Avery to Commonwealth	6
" Commonwealth to Trumbull	8
" crossing Trumbull	4
" Lincoln to Seventh	6
" Seventh to Fourth	4
" Third to Cass, both sides	4
" Cass to 373 ft. w. of Rivard	4
" 373 ft. w. of to Rivard	6
" Russell to w. line of Dubois	4
" crossing Dubois from e. to w	6
" e. line of Dubois to 190 ft. w. of Grandy	4
" 190 ft. w. of Grandy to e. line of same	6
" McDougall to e. line of Collins	6
" e. line of Collins to Moran	4
" Moran to 157 ft. w. of Beaufait	6
" 157 ft. w. of to Beaufait	4
" e. from Baldwin 164 ft	4
" alley s. of St. Antoine to 374 ft. w. of Hastings	6
" alley s. of 374 ft. w. of to Hastings	4
Forsyth ave., Baltimore to alley s. of same	6
Fort st., w. line of Artillery to Twenty-fourth	8
" Twenty-fourth to Hoffman	6
" Hoffman to Fourteenth	8
" Fourteenth to Tenth	6
" 20 ft. w. of e. of Tenth to 21 ft. w. of e. of Seventh	12
" Seventh to Woodward	16
" Griswold to Woodward	4
" St. Antoine to Meldrum	4
" 168 ft. w. of to Helen	4
" alley s. of Eighth to Seventh	4
" alley s. of Seventh to Fifth	8
" alley s. of 10 ft. w. of Third to Cass	4
" alley s. of Cass to Shelby	6
" alley s. of Shelby to 16 ft. w. of e. line of Griswold	4
" alley s. of 16 ft. w. of e. line of Griswold to alley w. of Woodward	8
" alley s. of alley e. of Randolph to St. Antoine	4
Foundry st., Baker to Michigan	6
Fourth st., Woodbridge to Larned	4
" Larned to Congress	8
" Fort to Grand River	6
" alley w. of Labrosse to alley s. of Michigan	4
Fourth ave., Grand River to Bagg	4
" Bagg to Calumet	6

LOCATION.	DIAM. INCHES.
Fourth ave., Calumet to s. line of Kirby	4
" s. to n. line of Kirby	6
" n. line of Kirby to 21 ft s. of n. of Bratshaw	4
" 21 ft. s. of n. of Bratshaw to 13 ft. s. of n. of Holden	10
" alley w. of Brainard to alley n. of	4
" alley w. of Selden to alley s. of	4
" alley w. of Lysander to Prentiss	3
Fourteenth ave., Fort to Lafayette	8
" Lafayette to Bagg	10
" Bagg to Grand River	8
" Grand River to s. line of N. Boulevard	6
" s. to n. line of N. Boulevard	8
" (w. side) n. from Porter 402 ft	4
Fox st., Frank to Alexandrine	3 & 4
Frank st., Seventh to 23 ft. e. of w. of Sixth	6
" Sixth to Fourth	4
Franklin st., Randolph to Beaubien	4
" Beaubien to Orleans	6
" Orleans to 25 ft. e. of Dequindre	4
" 25 ft. e. of Dequindre to McDougall	6
" Walker to Adair	4
" 325 ft. w. of to Leib	4
" alley s. of McDougall to Walker	4
Frederick st., Woodward to 124 ft. e. of Riopelle	4
" 124 ft. e. of Riopelle to 139 ft. e. of same	6
" 252 ft. w. of St. Aubin to Jos. Campau	4
" Collins to 126 ft. e. of Moran	6
" 30 ft. w. of e. of Bellevue to 22 ft. e. of w. of Concord.	6
" Helen to 69 ft. w. of w. of Frontenac Boulevard	4
" connecting two mains in Mt. Elliott ave	6
Freemont pl., Collins to 443 ft. w. of Moran	6
" 443 ft. w. of to Moran	4
Front st., Third to 107 ft. e. of same	6
" Second 170 ft. e. of First	4
Frontenac Boulevard, (w. side) s. from 42-in. main in Jefferson to B. I. Park	10
" (w. side) crossing Jefferson ave. from main to n. line	6
" (w. side) main in Mack to n. line	4
" (w. side) s. line of Gratiot to n. side Hendrie Boulevard	6
" (w. side) crossing Farnsworth, Ferry and Hendrie	8
" (e. side) 424 ft. s. of to 220 ft. s. of Jefferson	3
" (e. side) 220 ft. s. of Jefferson to 30 ft. s. of n. of St. Paul	6
" (e. side) 30 ft. s. of n. of St. Paul to s. line of Waterloo	4
" (e. side) s. line of Waterloo to 42-in. main in Mack	6
" (e. side) s. of Mack crossing Boulevard 76 ft	6
" (e. side) 4-in. pipe to 18 ft. n of n. line Mack	4
" (e. side) 42-in. main in Mack to 27 ft. n. of s. line of Gratiot	10
" (e. side) n. of 6-in. main from Gratiot n. 53 ft.	6
" (e. side) crossing Farnsworth st. and Hendrie Boulevard	6

LOCATION.	DIAM. INCHES.
ontenac Boulevard, crossing Frontenac Boulevard s. of Jefferson 424 ft. s. of and 220 ft. s. of	3
rontenac ave., s. from Medbury 93 ft	6
alster st., Canfield to Forest	6
arfield ave., Woodward to 367 ft. e. of e. of John R.	4
" 367 ft. e. of e. of John R. to 10 ft. w. of Brush	6
" 10 ft. w. of Brush to e. line of Brush	4
" e. line of Brush to 222 ft. w. of Beaubien	6
" 222 ft. w. of Beaubien to e. line of St. Antoine	4
" e. line of St. Antoine to 346 ft. w. of Hastings	6
" 346 ft. w. of to Hastings	3
" Hastings to w. line of Dubois	4
" crossing Dubois w. to e. line	6
" e. line of Dubois to Chene, w. line	4
" w. line of Chene to e. line of Grandy	6
" e. from McDougall 218 ft	4
" crossing Collins	6
" 188 ft. w. of Galster to 213 ft. w. of Moran	6
" 213 ft. w. of to Moran	4
" crossing Moran e. side	6
" crossing Mt. Elliott 53 ft	6
" 182 ft. w. of to Beaufait	4
" alley s. of, St. Antoine to 374 ft. w. of Hastings	6
" alley s. of, 374 ft. w. of to Hastings	4
" alley s. of, Hastings to 335 ft. e. of same	3
Gillette ave., Greeley e. of 366 ft	6
Gilman st., Grand River to Cass	16
Gladstone ave., 803 ft. w. of to 16-in. in Woodward	6
Glynn ct., 300 ft. w. of to w. line of Woodward	4
" w. line of Woodward to 16-in main	6
Goethe st., Crane to Holcomb	4
" e. from McClellan 228 ft	4
Goldner ave., Michigan to G. T. R. R.	6
Grand River ave., Woodward to Cass	8
" Cass to Third	6
" Third to 400 ft. w. of Humboldt	8
" 400 ft. w. of Humboldt to Vinewood	6
" Vinewood to N. Boulevard	10
" N. Boulevard to city limits	6
" Calumet to Buchanan	30
" connecting 30-in. with 8-in. in Buchanan 22 ft	8
" (s. side) Second to 56 ft. e. of Cherry	4
" (n. side) e. from Eighth 110 ft	3
" alley n. of, 10 ft. w. of Bagley to alley w. of Bagley	4
" alley north of, Fourth to Union	4
" alley n. of, w. from Lincoln 47 ft	4
" alley n. of, Trumbull to alley w. of same	6
" alley n. of, Wabash to alley w. of same	6
Grandy ave., Gratiot to Pierce	8
" Pierce to Harper	6
" N. from Harper 322 ft	4
" 322 ft. n. of Harper to Chene	6
Granger st., e. from Baldwin 259 ft	6
" 259 ft. e. of Baldwin to Van Dyke	4
Grant ct., n. from Warren 313 ft	4
Grant st., Thirteenth to Twelfth, w. line	3
" crossing w. side of Twelfth	4

	LOCATION.	DIAM. INCHES.
Granville pl.,	Wabash to e. line of same	4
"	e. line of Wabash to Thirteenth	3
Gratiot ave.,	Woodward to Raynor	30
"	Raynor to w. line of Rivard (s.)	10
"	w. line of Rivard (s.) to St. Aubin	12
"	Woodward to Brush	10
"	Brush to 64 ft. w. of Sheridan	6
"	64 ft. w. of Sheridan to 266 ft. w. of Harper	8
"	266 ft. w. of Harper to Cadillac	6
"	alley s. of, alley e. of Woodward, to Farmer	4
"	alley s. of, Farmer to alley e. of Farrar	6
Greeley ave.,	Alger to Gillette	6
Greenwood ave.,	Bagg to Calumet	6
"	crossing Calumet	8
"	n. line of Calumet to N. Boulevard	6
Griffin st.,	see N. Boulevard	
Griswold st.,	Detroit River to Atwater	3
"	Atwater to State	6
"	25 ft. n. of n. of Grand River to 16 ft. s. of s. of Clifford	8
"	16 ft. s. of s. line of Clifford to 12-in. main in Clifford	10
Grummond ave.,	Hamilton Boulevard to 16-in. main in Woodward	6
Guilloz st.,	Clay to Sidney	6
Guoin st.,	Russell to Orleans	4
"	Orleans to McDougall	10
"	McDougall to Walker	6
Haigh ave.,	16-in. main to e. line of Woodward	6
"	e. line of Woodward to 158 ft. e. of same	4
"	158 ft. e. of Woodward to 668 ft. e. of e. of same	6
"	22 ft. w. of e. of Cameron to 365 ft. e. of Greeley	6
Hale st.,	Riopelle to St. Aubin	6
"	e. from St. Aubin 275 ft	4
"	275 ft. e. of St. Aubin to Dubois	3
"	Dubois to Chene	4
"	Chene to Grandy	3
"	Grandy to Jos. Campau	6
Hamilton ave.,	Mack to 3 ft. s. of s. of Warren	6
Hamilton Boulevard,	crossing N. Boulevard	10
"	n. line of N. Boulevard to 26 ft. s. of s. line of Blaine	4
"	26 ft. s. of s. of Blaine to Bancroft	10
Hamlin ave.,	Woodward to Oakland	4
Hammond ave.,	Toledo to s. line of L. S. & M. S. R. R.	6
"	356 ft. s. of Leavitt to 175 ft. n. of Ranspach	6
"	Poplar to Horatio	6
Hancock ave.,	Scotten to La Salle	4
"	crossing Hubbard Boulevard 165 ft	6
"	w. line of Vinewood to Twenty-sixth	4
"	Twenty-fifth to e. line of Twenty-fourth	4
"	Twenty-third to 155 ft. e. of e. line of same	4
"	155 ft. e. of e. of Twenty-third to 20 ft. w. of e. of Williams	6
"	Eighteenth to Seventeenth	4
"	crossing Fourteenth	4
"	Fourteenth to w. line of Wabash	3
"	w. line of Wabash to 130 ft. w. of Thirteenth	6
"	130 ft. w. of Thirteenth to Avery	4
"	Avery to Commonwealth	6

	LOCATION.	DIAM. INCHES.
Hancock ave.,	Commonwealth to Fourth	4
"	s. side e. from Third 10 ft	4
"	crossing Third	6
"	n. side e. from Third 461 ft	4
"	n. side 461 ft. e. of Third to Second	6
"	w. line of Cass to 112 ft. e. of Riopelle	4
"	488 ft. w. of to St. Aubin	6
"	St. Aubin to w. line of Dubois	4
"	crossing Dubois	8
"	281 ft. w. of Chene to Grandy	4
"	31 ft. e. of w. of. Jos. Campau to 28 ft. w. of e. of Mitchell	6
"	Mitchell to McDougall	4
"	e. from McDougall 281 ft	6
"	crossing Collins	6
"	e. line of Collins to Detloff ct	4
"	Detloff ct. to alley w. of Ellery pl	6
"	alley w. of Ellery to alley w. of Mt. Elliott	4
"	crossing Mt. Elliott from w. to e. line	6
"	Canton to Helen	6
"	alley s. of Greenwood to Leroy pl	4
"	alley s. of alley e. of Riopelle to w. line of Orleans	3
"	alley s. of crossing w. side of Orleans	4
Hanover ave.,	crossing Russell, e. side	4
Harmon ave.,	16-in. main to e. line of Woodward	6
"	e. line of Woodward to Oakland	4
Harper ave.,	Fifteenth to 134 ft. w. of Fourteenth	6
"	134 ft. w. of to Fourteenth	4
"	crossing Fourteenth	6
"	29 ft. w. of e. of Thirteenth to 176 ft. w. of Twelfth	6
"	176 ft. w. of to Twelfth	4
"	Woodward to Russell	4
"	Widman pl. to 184 ft. e. of Dubois	4
"	184 ft. e. of Dubois to w. line of Chene	6
"	w. line of Chene to 28 ft. w. of e. of Mitchell	4
"	28 ft. w. of e. of Mitchell to w. line of McDougall Boulevard	6
"	crossing McDougall Boulevard	8
"	crossing Collins	8
"	e. line of Collins to e. line of Mt. Elliott	6
"	Baldwin to 433 ft. e. of Van Dyke	6
"	Rohns to Holcomb	6
"	Gratiot to Cadillac	6
"	alley s. of, John R. to 350 ft. e. of same	4
"	alley s. of, crossing Brush	4
Harrison ave.,	crossing Michigan	12
"	Michigan to Grand River	4
"	alley w. of Linden s. to Linden n	4
Harvey ave.,	Junction to 500 ft. w. of Campbell	4
Hastings st.,	s. line to 16-in. main in Jefferson	16
"	Jefferson to Champlain	24
"	118 ft. s. of Congress to Fort	3
"	Champlain to Monroe	3
"	Congress to Clinton	6
"	Clinton to s. line of Mullett	4
"	crossing s. side of Mullett	8
"	Mullett to Catherine	12

LOCATION.		DIAM. INCHES.
Hastings st.,	Catherine to Watson	6
"	Watson to Canfield	10
"	Canfield to Theodore	8
"	s. line of Farnsworth to s. line of Medbury	6
"	s. line of Medbury to Harper	8
"	Harper to Piquette	6
"	Piquette to s. line of Trombly	4
"	s. line of Trombly to s. line of N. Boulevard	6
"	crossing N. Boulevard	8
"	n. line of N. Boulevard to Custer	4
"	Custer to Marston	6
"	first alley e. of, alley s. of to 12 ft. s. of s. line of Canfield	3
"	first alley e. of, 12 ft. s. of s. to 21 ft. n. of s. line of Canfield	4
"	first alley e. of, first alley s. of Garfield to Cracow pl.	6
"	second alley e. of, second alley s. of Garfield to first alley s. of same	6
Hazel st.,	Thirteenth to 96 ft. e. of same	4
"	96 ft. e. of Thirteenth to 156 ft. w. of Twelfth	3
"	156 ft. w. of Twelfth to Harrison	4
"	25 ft. w. of e. of Harrison to 25 ft. w. of e. of National	6
Hazelwood ave.,	e. from 10-in. main in Hamilton Boulevard 28 ft.	6
"	13 ft. w. of e. of Hamilton Boulevard to w. line of Woodward	4
"	w. line of Woodward to 16-in. main	6
Heck pl.,	crossing n. side of Forest	4
"	Forest to Hancock	3
Hecla ave.,	Merrick to 343 ft. n. of Kirby	4
"	687 ft. s. of s. of Piquette to Milwaukee	6
Heidelberg st.,	Jos. Campau to alley e. of same	6
"	alley e. of McDougall to w. line of Elmwood	3
"	crossing Elmwood, w. side, 39 ft.	4
"	Elmwood to Mt. Elliott	6
Helen ave.,	Jefferson to 91 ft. s. of s. of Macomb	6
"	crossing Mack	6
"	Gratiot to 192 ft. n. of Medbury	6
Hendricks st.,	St. Aubin to Dubois	3
"	Dubois to alley w. of McDougall	4
"	alley e. of McDougall to Elmwood	4
"	Elmwood to 522 ft. w. of Mt. Elliott	6
"	522 ft. w. of to Mt. Elliott	4
Hendrie ave.,	Woodward to 550 ft. e. of John R	4
"	550 ft. e. of John R. to w. line of Brush	6
"	crossing Brush and St. Aubin	4
"	crossing Hastings	6
"	Dubois to 224 ft. e. of same	6
"	224 ft. e. of Dubois to e. line of Chene	4
"	e. from e. line of Chene, 148 ft.	6
"	148 ft. e. of e. of Chene to e. line of Grandy	4
"	e. line of Grandy to e. line of McDougall	6
"	alley s. of, from 378 ft. w. of w. to 16 ft. w. of e. of Rivard	6
Hendrie Boulevard,	(s. side) crossing Collins, Ellery, Moran	6
"	32 ft. w. of e. of McDougall Boulevard to 12 ft. w of e. of Collins	6

LOCATION.		DIAM. INCHES.
ndrie Boulevard,	12 ft. w. of e. of Collins to 20 ft. w. of e. of Mt. Elliott	10
"	20 ft. w. of e. of Mt. Elliott to 12 ft. e. of w. of Frontenac Boulevard	8
"	(s. side) crossing Mt. Elliott, Meldrum, Beaufait	6
"	(s. side) crossing Bellevue, Concord, Canton	6
"	(s. side) crossing Helen	6
"	(n. side) Mt. Elliott to e. side Frontenac ave	8
"	Baldwin to 264 ft. e. of same	6
"	264 ft. e. of Baldwin to 24 ft. w. of e. of Van Dyke	4
"	24 ft. w. of e. of Van Dyke to w. line of Maxwell.	6
enrietta ave.,	crossing Campbell	6
enry st.,	alley e. of to Third	4
"	Third to Cass	6
"	Clifford to Woodward	4
erbert st.,	134 ft. w. of Lovett to Scotten	4
ibbard ave.,	Jefferson to 202 ft. n. of Brinket	6
High st.,	National to alley w. of Trumbull	3
"	alley w. of Trumbull to Fourth	4
"	Fourth to w. line of Third	3
"	w. line of to Third	4
"	Third to Grand River	6
"	Grand River to 26 ft. e. of e. of Woodward	4
"	27 ft. e. of w. of Woodward to 3 ft. w. of e. of John R	8
"	3 ft. w. of e. line of John R. to w. line of Beaubien	4
"	w. line of Beaubien to St. Antoine	6
"	St. Antoine to Russell	4
"	Russell to Riopelle	3
Hoffman st.,	River st. to Fort	8
Holborne ave.,	crossing Mt. Elliott, w. side	6
"	e. from Mt. Elliott 170 ft	4
Holbrook ave.,	Woodward to 360 ft. e. of e. line of same	6
Holcomb ave.,	Jefferson to Louis	6
"	Goethe to Mack	6
"	274 ft. s. of s. of Gratiot to Harper	6
Holden ave.,	Third to Cass	10
"	Cass to Woodward	6
Holden road,	Third to Fourth	4
"	Fourth to N. Boulevard s. line	8
"	s. line of to 24-in. main in N. Boulevard	10
"	Lincoln to Greenwood	4
Homer st.,	w. from Crane 215 ft	4
Hooker ave.,	e. from Grand River 63 ft	4
"	Sullivan to 596 ft. w. of Eighteenth	6
"	596 ft. w. of to Eighteenth	4
Horatio st.,	Livernois to Welch	4
"	Welch to Howell	6
"	Thirty-third to Thirty-second	6
"	Scotten to La Salle	6
Horton ave.,	Woodward to Oakland	4
Houghton ave.,	Holcomb to McClellan	4
Howard st.,	Campbell to 343 ft. w. of Junction	6
"	343 ft. w. of to Junction	4
"	Scotten to alley e. of	4
"	Twenty-fifth to Twenty-fourth	4
"	Twenty-fourth to w. side M. C. R. R. bridge	6

LOCATION.	DIAM. INCHES.
Howard st., Twelfth to Tenth	6
" alley s. of, Fourteenth to alley e. of same, 190 ft.	3
" alley s. of, 333 ft. w. of to Tenth	4
" alley s. of, Tenth to First	6
" alley s. of, First to Shelby	4
Howell st., alley s. of to n. line of Buchanan	6
" n. from Horatio 680 ft.	6
Hubbard ave., Fort to 335 ft. n. of Brandon	6
" E st. to Michigan	4
" Michigan to Myrtle	6
" alley w. of, Howard to Porter	4
Hubbard Boulevard, Myrtle to Visger	6
" (e. side) Buchanan to Hancock	6
" (e. side) crossing Warren	4
" (e. side) n. line of Warren to n. line of McGraw	6
" (e. side) McGraw to Scovel pl.	4
" (e. side) Scovel pl. to 161 ft. s. of N. Boulevard	6
" (e. side) 161 ft. s. of to N. Boulevard	4
" (w. side) crossing Buchanan	6
" (w. side) s. line of Hancock to n. line of McGraw	6
" (w. side) s. from N. Boulevard 117 ft.	6
" (both sides) crossing Scovel, Moore and Wreford	6
Hudson ave., Vinewood to e. line of same	6
" e. line of Vinewood to Twenty-sixth	4
" Twenty-sixth to 25 ft. e of w. of Twenty-third	6
" Twenty-third to Maybury	4
" Maybury to Grand River	6
" w. line of Humboldt to 144 ft. w. of Eighteenth	4
" 144 ft. w. of to Eighteenth	6
" crossing e. side of Eighteenth	4
" Fifteenth to Wabash	6
" Seventh to 564 ft. w. of Greenwood	6
" 564 ft. w. of to e. line of Greenwood	4
" crossing w. side of Fourth	4
Humboldt ave., Michigan to s. line of Butternut	4
" crossing Butternut	6
" n. line of Butternut to s. line of Buchanan	4
" crossing Buchanan	6
" n. line of Buchanan to D. & B. C. R. R.	4
" s. line of Warren to McGraw	6
Hunt st., Dubois to alley w. of McDougall	4
" alley e. of McDougall to Elmwood	4
" Ellery to Mt. Elliott	4
Hurlbut ave., crossing Jefferson to 21 ft. n. of same	6
" n. from Mack 360 ft.	6
Huron st., s. from Locust 295 ft.	3
" Locust to Bagg	6
Hussar st., Dragoon to Military	6
" 25 ft. w. of e. of Military to 204 e. of e. of same	6
Illinois st., Brush to Russell	6
" Russell to St. Aubin	4
" St. Aubin to w. line of Dubois	3
" crossing Dubois	4
" Dubois to w. line Chene	3
" crossing Chene	4
" Chene to w. line of Grandy	3

LOCATION.	DIAM. INCHES.
Illinois st., w. line of Grandy to Jos. Campau	6
" e. from McDougall 241 ft	3
" 241 ft. e. of McDougall to 4 ft. w. of w. of Collins	4
" 4 ft. w. of w. of Collins to 4 ft. e. of e. of same	6
" 193 ft. w. of to Moran	4
Indiana st., Beaubien to Russell	8
Ingersoll st., e. from Wesson 226 ft	4
Iron st., Wight to Jefferson	6
Iroquois ave., 6 ft. s. of Champlain to 21 ft. s. of n. of Agnes	8
" 21 ft. s. of n. of Agnes to 2 ft. n. of n. of St. Paul	6
" alley e. of, 5 ft. n. of s. of alley n. of Jefferson to 115 ft. n. of same	4
Irving st., Seventh to Greenwood	4
Ivy pl., Twenty-third to Grand River	6
Jackson st., Thirty-fifth to Thirty-fourth	6
" Thirtieth to Twenty-ninth	6
" Twenty-ninth to e. line of Scotten	4
Jay st., Riopelle to 44 ft. w. of McDougall	4
" crossing Jos. Campau e. to w. lines	6
Jefferson ave., First to Griswold	8
" Griswold to Orleans	10
" Dequindre to w. side of Belt Line R. R.	6
" e. side of Belt Line to McClellan	6
" McClellan to e. city limits	10
" e. from e. city limits to 178 ft. e. of e. of entrance to Driving Park grounds	8
" 178 ft. e. of e. of Driving Park to 27 ft. w. of e. of Marshland road	6
" Second to Hastings	16
" Meldrum to pumping works (main No. 1)	42
" Crane to pumping works (main No. 3)	42
" alley s. of Cass to Shelby	4
" alley s. of, alley w. of Griswold to alley w. of Woodward	4
" alley s. of, alley w. of Bates to Randolph	4
" alley s. of Brush to Beaubien	3
" alley s. of, Beaubien to 189 ft. e. of same	4
" alley n. of, 15 ft. w. of e. of Parker to alley e. of Iroquois	4
Joe st., Michigan to alley s. of Buchanan	6
John R. st., Woodward to Miami	12
" n. side Miami to s. side of Madison	4
" n. side Madison to Adams	4
" Adams to Columbia	6
" Columbia to Edmund	8
" Edmund to s. line Rowena	6
" s. line Rowena to Brady	8
" Brady to s. line of Canfield	6
" crossing Canfield	8
" n. line Canfield to s. line of N. Boulevard	6
" crossing N. Boulevard, s. side	8
" Horton to Hamlin	6
Johnson st., Nineteenth to alley w. of Eighteenth	4
Jones st., Sixth to 160 ft. w. of Fifth	6
" 160 ft. w. of Fifth to Cass	4
Jos. Campau ave., Atwater to Clinton	6
" 25 ft. n. of s. of Catherine to 20 ft. n. of s. of Jay	8

	LOCATION.	DIAM. INCHES.
Jos. Campau ave.,	Jay to s. line of Gratiot	6
"	s. line of Gratiot to St. Joseph	4
"	St. Joseph to Trombly	6
"	Trombly to 250 ft. n. of Milwaukee	4
"	250 ft. n. of Milwaukee to s. line of N. Boulevard	6
"	crossing N. Boulevard	8
"	N. Boulevard to 10 ft. n. of Denton (w. side)	6
"	alley e. of, Mullett to Jay	4
"	alley e. of, Cleveland to Hendricks	3
"	alley e. of, Hendricks to Hunt	4
"	alley e. of, Hunt to Charlevoix	3
"	alley e. of, Charlevoix to Heidelberg	4
Josephine ave.,	16-in. main to 1,905 ft. e. of e. of Woodward	6
Joy st.,	Fifth to Fourth	4
"	Fourth to alley e. of Third	6
"	alley e. of Third to Cass	4
Julia st.,	Wesson to Bushey	6
Junction ave.,	River to Fort s. line	6
"	s. line of Fort to Otis	8
Kanter ave.,	crossing Collins	6
"	185 ft. w. of Collins to Moran	4
"	166 ft. w. of to Mt. Elliott	4
"	crossing e. side McDougall Boulevard	6
Kercheval ave.,	Mt. Elliott to Beaufait	8
"	Field to Baldwin	4
King ave.,	16-in. main in Woodward to 871 ft. e. of e. of Brush	6
Kinsman st.,	Twenty-eighth to Scotten	4
Kirby ave.,	Vinewood to 247 ft. w. of Twenty-seventh	6
"	247 ft. w. of to Twenty-seventh	4
"	24 ft. w. of e. of Maybury to 219 ft. e. of e. of Sullivan	6
"	crossing Humboldt	4
"	Eighteenth to 87 ft. e. of Sixteenth	4
"	87 ft. e. of Sixteenth to 126 ft. w. of Fourteenth	6
"	126 ft. w. of to Fourteenth	4
"	Fourteenth to Wabash	6
"	Thirteenth to 19 ft. e. of w. of Twelfth	6
"	19 ft. e. of w. of Twelfth to 49 ft. e. of w. of Trumbull	8
"	49 ft. e. of w of Trumbull to Cass	10
"	23 ft. w. of e. of Cass to 18 ft. w. of e. of Rivard	16
"	crossing e. side of Rivard	8
"	e. from Russell 216 ft	4
"	St. Aubin to Chene	4
"	23 ft. w. of e. of Chene to 154 ft. e. of e. of same	6
"	154 ft. e. of e. of Chene to w. line of Grandy	3
"	crossing Grandy	4
"	crossing Collins	6
"	85 ft. w. of Moran to 438 ft. e. of e. of same	6
"	connecting two mains in Mt. Elliott	6
"	Concord to Canton	6
"	e. from Helen 238 ft	4
"	Sheridan to Townsend	6
"	Baldwin to 161 ft. e. of same	6
"	161 ft. e. of Baldwin to Van Dyke	4
Koch ave.,	16-in. main to e. line of Woodward	6
"	e. line of Woodward to w. line of Oakland	4
"	crossing w. side of Oakland 26 ft	6
Kolb st.,	Crane ave. to 470 ft. e. of e. of same	6

	LOCATION.	DIAM. INCHES.
brosse st.,	crossing e. side of Twelfth	6
"	e. line of Twelfth to 430 ft. w. of Tenth	4
"	430 ft. w. of to Tenth	3
"	Fifth to Fourth	4
"	alley s. of alley e. of Twelfth to Fourth	4
dy's lane,	n. from Dry Dock st. 214 ft	4
fayette ave.,	Artillery to Dragoon	6
"	Dragoon to 123 ft. e. of same	4
"	123 ft. e. of Dragoon to 315 ft. w. of Junction	6
"	315 ft. w. of to Junction	4
"	crossing Clark	6
"	e. from Scotten 256 ft	4
"	256 ft. e. of to 352 ft. e. of Scotten	6
"	Twenty-fourth to e. line of Twenty-second	4
"	Eighteenth to 110 ft. w. of w. line of Seventeenth	6
"	110 ft. w. of w. of to Seventeenth	4
"	alley w. of Sixteenth to Fifteenth	4
"	Fifteenth to w. line of Fourteenth	3
"	Fourteenth to Twelfth	4
"	crossing Twelfth, e. side	6
"	M. C. R. R. bridge to 743 ft. w. of Tenth	3
"	743 ft. w. of to Tenth	4
"	Shelby to Griswold	4
"	alley s. of, Tenth to Fifth	4
"	alley s. of, Fourth to First	4
"	alley s. of, First to Wayne	6
"	alley s. of, Shelby to Griswold	6
Lafferty pl.,	Howard to s. side M. C. R. R.	6
Lambie pl.,	crossing w. side of Twenty-third	4
"	crossing from w. to e. of Twenty-second	4
"	Twenty-second to Twenty-first	6
Lambert st.,	crossing e. side of Mt. Elliott	6
"	Concord to Canton	4
"	e. from Baldwin 235 ft	6
"	235 ft. e. from Baldwin to Van Dyke	4
Langley ave.,	Seventh to 141 ft. e. of e. of same	6
"	141 ft. e. of e. of Seventh to Fourth	4
Lanman st.,	crossing e. side of Vinewood	4
"	e. side Vinewood to Twenty-seventh	6
Lansing ave.,	Fort to 159 ft. n. of Christiancy	6
"	337 ft. s. of Dix to Toledo	6
Larned st.,	Fifth to Fourth	4
"	Fourth to Third	8
"	alley w. of to Woodward	8
"	Third to Hastings	16
"	Bates to Brush	4
"	St. Antoine to Dequindre	4
"	Riopelle to St. Aubin	12
"	St. Aubin to w. line Elmwood	4
"	w. line of Elmwood to 748 ft. e. of	6
"	Leib to alley e. of	4
"	w. line of Mt. Elliott to main, 26 ft	4
"	Mt. Elliott to Meldrum 25 ft. w. of e	6
"	w. from Helen 156 ft	4
"	alley s. of, Third to First	8
"	alley s. of, First to Griswold	4

LOCATION.	DIAM. INCHES.
Larned st., alley s. of, Shelby to Griswold	8
" alley s. of, crossing Griswold (e. side) to 12 ft. w. of e. of same	4
" alley s. of, 12 ft. e. of e. of Griswold to 8 ft. w. of e. of alley w. of Woodward	8
La Salle ave., Michigan to Horatio	6
" Kirby to McGraw	6
Lauderdale ave., Campbell to 273 ft. w. of w. of Junction	6
" 273 ft. w. of to Junction	4
Laurel st., Wabash to Grand River	4
Lawrence ave., 16-in. main in Woodward to 1,212 ft. w. of w. of same	6
Leach st., w. from Crane 215 ft	4
Leavitt ave., Livernois to Wesson	4
Ledyard st., Third to Cass	6
Leib st., Wight to Jefferson	6
" Jefferson to Champlain	4
" 42-in. main in Champlain to 18 ft. s. of n. of Monroe	8
Leicester st., 16-in. main to e. line of Woodward	6
" e. from Woodward 1,379 ft	4
Leland st., 2 ft. w. of e. of Brush to Beaubien	6
" Beaubien to Russell	4
" Russell to McDougall	8
" McDougall to Collins	3
" w. line of Collins to 6 ft. e. of e. of same	6
" 216 ft. w. of Moran to Gratiot	4
Lemay ave., Jefferson n. 607 ft (outside city limits)	6
Leroy pl., n. from Forest 251 ft	3
Lessing st., e. from McClellan 158 ft	4
Leverette st., Twelfth to Tenth	4
" Eighth to Seventh	4
" alley s. of, Tenth to Eighth	4
Lewis st., Fourth to Cass	4
" alley s. of, alley e. of Third to Second	4
Lincoln ave., Grand River main to alley n. of	4
" crossing Calumet n. side 36 ft	8
" n. line Calumet to Holden	6
" crossing n. side Holden	8
" n. line of Holden to Milwaukee	6
" crossing s. side N. Boulevard 87 ft	6
" alley w. of, alley n. of Grand River to s. line of Brainard	4
" alley w. of, s. line of Brainard to 30-in. main in Calumet	6
Linden st., 26 ft. e. of Twenty-sixth to Twenty-fifth	4
" Twenty-fourth to Tillman	4
" Maybury to 137 ft. e. of e. of Humboldt	4
" 137 ft. e. of e. of Humboldt to Eighteenth	6
" Eighteenth to Harrison	4
Livernois ave., Dix to M. C. R. R	8
" M. C. R. R. to n. city limits	10
Locust st., Wabash to Harrison	4
" National to 30 ft. e. of same	4
" 30 ft. e. of National to alley w. of Trumbull	3
" alley e. of Trumbull to Fourth	4
" Fourth to Grand River	6
Lombard terrace, alley w. of Avery to Twelfth	6
Longfellow ave., 16-in. main to w. line of Woodward	6
Lorman ave., Crane to Belvidere	4

LOCATION.	DIAM. INCHES.
Lothrop ave., Hamilton Boulevard to Woodward	6
Louis ave., Crane to Holcomb	4
Lovett ave., Michigan to n. line of Buchanan	6
" Rich to 93 ft. n. of n. of Horatio	4
" 93 ft. n. of Horatio to 264 ft. n. of Herbert	6
" alley w. of, Visger to Jackson	6
Ludden st., Gratiot to Mt. Elliott	4
Lyman st., Crystal to Orleans	4
" 4 ft. w. of w. of Chene to 23 ft. w. of e. of same	6
Lysander st., crossing e. side Thirteenth 21 ft	6
" e. line of Thirteenth to Avery	4
" Lincoln to Seventh	4
" Seventh to w. line of Sixth	3
" crossing w. side Sixth	4
" Greenwood to Fourth	3
McArthur st., Vinewood to 70 ft. e. of e. of same	6
" 70 ft. e. of Vinewood to Twenty-seventh	4
McClellan ave., Jefferson to Marietta	6
" Marietta to Mack	8
" s. line of Mack to 144 ft. n. of Emmons	10
" n. from Gratiot 299 ft	8
McDougall ave., Atwater to Guoin	6
" Guoin to Wight	10
" Wight to Clinton	6
" crossing Waterloo, Cleveland and Arndt	8
" Preston to Gratiot	8
" Gratiot to Canfield	4
" Canfield to 187 ft. n. of Garfield	6
" 187 ft. n. of Garfield to Forest	8
" Forest to Hancock	6
" Theodore to Farnsworth	6
" Palmer to Hendrie	6
" alley e. of, Mullett to Chestnut	4
" alley e. of, Waterloo to s. line of Cleveland	3
" alley e. of, crossing Cleveland	4
" alley e. of, Cleveland to s. line of Arndt	3
" alley e. of, crossing Arndt	6
" alley e. of, n. line of Arndt to Preston	3
McDougall Boulevard, 22 ft. n. of s. of Hendrie Boulevard, to 29 ft. s. of n. of Griffin	6
McGraw ave., Scotten to 76 ft. e. of La Salle	4
" 76 ft. e. of La Salle to Twenty-sixth	6
" Twenty-sixth to Grand River	4
" Winslow to Sullivan	6
" Sullivan to Sixteenth	4
McGregor st., Campbell to Junction	6
McKinstry ave., River st. to n. line of Toledo	6
" Brandon to Plumer	6
" alley w. of, Plumer to alley s. of same	4
McMillan st., crossing Livernois, e. side	4
" Campbell to 319 ft. w. of Junction	6
" 319 ft. w. of to Junction	4
Mack ave., Riopelle to St. Aubin	6
" e. from St. Aubin 300 ft	4
" 100 ft. w. of to Dubois, w. line	3
" crossing Dubois	4
" e. line of Dubois to w. line Chene	3

LOCATION.	DIAM. INCHES.
Mack ave., crossing Chene	4
" Chene to e. line of Grandy	3
" Grandy to Jos. Campau	6
" e. from McDougall 402 ft	4
" Gratiot to Cadillac from main No. 2	42
" Gratiot to Mt. Elliott	4
" crossing Mt. Elliott w. to e. line	6
" e. line of Mt. Elliott to Townsend	4
" Townsend to Baldwin	6
" Beals to 167 ft. e. of Parker	8
" 659 ft. w. of to 577 ft. w. of Fischer	8
" 207 ft. w. of to 65 ft. e. of Crane (s.)	8
" 30 ft. w. of w. of Rolfe pl. to 16 ft. w. of e. of same	8
" McClellan to Pennsylvania	8
" Pennsylvania to e. line of Hamilton	6
" e. line of Hamilton to e. line of Park	8
" e. line of Park to e. line Montclair	6
Macomb st., St. Antoine to Elmwood	4
" alley s. of, alley w. of to w. line of Brush	3
" alley s. of, w. line of Brush to St. Antoine	4
Madison ave.. (both sides), Witherell to John R.	4
" Randolph to 18 ft. e. of w. line of Brush	6
" Brush to Beaubien	8
" Beaubien to St. Antoine	4
" alley s. of, John R. to Randolph	4
Magnolia st., Vinewood to Twenty-seventh	4
" crossing Twenty-fourth	4
" Maybury to Sullivan	4
" Sullivan to w. line of Humboldt	3
" crossing Humboldt	4
" e. line of Humboldt to Eighteenth	3
" Fifteenth to Fourteenth	4
" Wabash to Thirteenth	3
" Thirteenth to Harrison	4
Mansur st., Harper to 78 ft. s. of Piquette	4
Maple st., Gratiot to Orleans	8
" Orleans to St. Aubin	4
" St. Aubin to w. line of Dubois	3
" crossing Dubois	8
" Dubois to Elmwood	3
" crossing Jos. Campau	6
Marcy st., Greenwood to 158 ft. w. of Fourth	4
" 158 ft. w. of to Fourth	3
Marietta st., e. from McClellan 521 ft	4
" 521 ft. e. of e. of McClellan to 109 ft. w. of w. of Pennsylvania	6
Mark st., Thirteenth to 176 ft. w. of Twelfth	6
" 176 ft. w. of to Twelfth	4
Marston ct., 16-in. main in Woodward to 251 ft. e. of e. of John R	6
" 243 ft. w. of w. of Oakland to Hastings	6
Martin pl., 10-in. main in Woodward to 20 ft. w. of e. of John R	8
Maxwell ave., alley n. of Jefferson to n. line of Champlain	4
" 18 ft. s. of n. of Champlain to 16 ft. n. of s. of Tonti	6
Maybury ave., Michigan to n. line of Ash	6
" n. line of Ash to 88 ft. s. of Grand River	8
Mechanic st., Brush to Beaubien	4
Medbury ave., Woodward to 364 ft. e. of e. of John R	4

	LOCATION.	DIAM. INCHES.
Medbury ave.,	364 ft. e. of e. of John R to 460 ft. e. of e. of same	3
“	22 ft. w. of e. of Brush to 128 ft. e. of e. of same	3
“	223 ft. w. of w. of St. Antoine to 149 ft. e. of e. of same	3
“	140 ft. w. of w. of Hastings to 168 ft. e. of e. of same	3
“	194 ft. w. of w. of Rivard to 22 ft. w. of e. of same	3
“	22 ft. w. of e. of Rivard to e. line of same	4
“	730 ft. w. of to w. line of St. Aubin	3
“	w. line of St. Aubin to Jos. Campau	4
“	Mitchell to e. line of Collins	6
“	538 ft. w. of to 168 ft. e. of Mt. Elliott	6
“	Canton to Helen	6
“	Helen to Frontenac	4
“	Baldwin to Van Dyke	6
“	alley s. of, John R. to 350 ft. e. of same	4
“	alley s. of, crossing Brush	6
Melbourne ave.,	crossing e. side of Woodward	6
Meldrum ave.,	Wight to Jefferson	10
“	Jefferson to 46 ft. n. of Fort	6
“	46 ft. n. of Fort to 360 ft. n. of Kercheval	4
“	360 ft. n. of to 642 ft. n. of Kercheval	6
“	Arndt to Gratiot	6
“	168 ft. s. of Forest to 30 ft. n. of s. of same	6
“	crossing N. Boulevard	6
“	Jefferson to Congress	42
Merrick ave.,	Vinewood to Twenty-seventh	4
“	Twenty-third to Tillman	4
“	Tillman to Williams	6
“	27 ft. w. of e. of Maybury to 212 ft. e. of e. of Sullivan	6
“	132 ft. w. of to Seventeenth	4
“	w. line of Wabash to Twelfth	6
“	Twelfth to 35 ft. w. of e. of Avery (s.)	4
“	35 ft. w. of, e. of Avery (s.) to 26 ft. e. of w. of Avery (n.) 99 ft.	6
“	26 ft. e. of w. of Avery (n.) to Trumbull	4
“	Lincoln to e. line of Greenwood	4
“	25 ft. w. of e. of Seventh to 20 ft. w. of e. of Greenwood (in s. lawn)	6
“	e. line of Greenwood to 136 ft. w. of Fourth	3
“	136 ft. w. of to Fourth	4
“	Third to 26 ft. e. of w. of Second	4
“	26 ft. e. of w. of Second to 21 ft. w. of e. of same	6
“	21 ft. w. of e. of Second to Cass	4
“	alley s. of. crossing e. side of Greenwood	4
“	alley s. of, e. line of Greenwood to alley w. of Fourth	3
Miami ave.,	Gratiot to Witherell	16
“	n. side of, John R. to Witherell	4
“	alley w. of alley s. of to Gratiot	6
“	alley w. of Gratiot to 80 ft. s. of Witherell	4
“	alley e. of, Randolph to John R.	4
Michigan ave.,	crossing W. Boulevard (s. side)	6
“	Livernois to Twenty-fourth	6
“	Twenty-fourth to Foundry	8
“	Vinewood to Tenth	24
“	Tenth to First	8
“	First to Washington	10
“	Cass to Woodward	24
“	alley s. of, Cass to Shelby	4

LOCATION.	DIAM. INCHES.
Michigan ave., private alley s. of, Shelby to 110 ft. e. of same	3
Middle st., alley s. of Grand River to 230 ft. e. of Clifford	4
Military ave., River st. to 250 ft. n. of Wabash R. R.	6
" 62 ft. n. of Anthon to Toledo	6
Miller st., crossing Seventh	4
" Seventh to Sixth	3
Milwaukee ave., 36 ft. w. of Sullivan to 4 ft. w. of w. of Eighteenth	4
" 4 ft. w. of w. of Eighteenth to w. line of Sixteenth	6
" crossing Fourteenth	6
" Twelfth to w. line of Avery	6
" Lincoln to Beaubien	6
" Beaubien to w. line of Riopelle	4
" w. line of Riopelle to Dubois	6
" Dubois to Chene	4
" Craig to w. line of Collins	6
" crossing Collins	8
" crossing Mt. Elliott w. line to 2 ft. w. of e.	6
Miner ave., e. from Crane 336 ft.	4
" 336 ft. e. of Crane to Holcomb	6
Minnie ave., 23 ft. n. of River st. to 582 ft. s. of Fort	6
" 582 ft. s. of to Fort	4
Mitchell ave., n. from Gratiot 265 ft.	6
" 265 ft. n. of Gratiot to Canfield	4
" Canfield to Harper	6
" n. from Harper 324 ft.	4
" 324 ft. n. of Harper to Trombly	6
" Trombly to Griffin	4
" crossing s. side of N. Boulevard	8
Mohawk st., crossing Vinewood, e. side	4
Monroe ave., Cadillac square to Randolph	12
" Randolph to St. Antoine	8
" St. Antoine to Elmwood	4
" 90 ft. n. of Cadillac square to Farmer	3
" 216 ft. w. of to 15 ft. e. of w. of Leib	4
" 15 ft. e. of w. of Leib to 26 ft. e. of w. of Mt. Elliott	6
" 185 ft. w. of to Helen	4
" alley s. of, alley n. of Cadillac square to Randolph	4
" alley s. of, Brush to 8-in. main in Beaubien	4
" alley s. of, 8-in. main in Beaubien to 261 ft. e. of same	3
" alley s. of, 261 ft. e. of Beaubien to St. Antoine	4
Montcalm st., Cass to main in Clifford	3
" crossing e. side of Clifford	6
" e. line of Clifford to w. line of Park	3
" crossing Park	6
" e. line of Park to 412 ft. w. of Woodward	3
" 412 ft. w. of to Woodward	4
" alley e of Woodward to Brush	4
" Brush to w. line of Beaubien	3
" w. line of Beaubien to Hastings	6
" Hastings to Russell	3
" alley s. of, 240 ft. w. of to Beaubien	4
Montclair ave., n. from 6-in. pipe in Mack to 6 ft. s. of s. line of Canfield	6
Montieth st., Vinewood to Twenty-seventh	6
Moore pl., crossing Hubbard Boulevard	6
" 25 ft. w. of e. of Twenty-sixth to 169 ft. e. of e. of same	6
Moran st., Gratiot to Dane	6

LOCATION.	DIAM. INCHES.
Morrell st., River st. to 87 ft. n. of n. of Christiancy	6
" 348 ft. s. of Dix to Toledo	6
" alley w. of 21 ft. n. of s. of Brandon to 4 ft. n. of s. of alley s. of Plumer	6
Mott ave., 16-in. main to e. line of Woodward	6
" e. from Woodward 558 ft	4
Mt. Elliott ave., 148 ft. s. of Wight to 285 ft. s. of Kercheval	6
" 285 ft. s. of Kercheval to Preston	8
" Preston to Mack	10
" Mack to Gratiot	8
" Gratiot to s. line of Hendrie Boulevard (e. side)	4
" crossing Boulevard	8
" n. line of Boulevard to 300 ft. n. of Griffin	4
" 300 ft. n. of Griffin to Forest Lawn Cemetery	6
" Gratiot to Warren (w. side)	6
" Harper to 182 ft. s. of (e. side)	6
Mullett st., Gratiot to Chene	30
" St. Antoine to Elmwood	4
Mulberry st., Thirteenth to Twelfth	4
Myrtle Boulevard, Hubbard Boulevard to alley w. of Twenty-sixth	6
Myrtle st., alley w. of Twenty-sixth to Grand River	6
Nall ave., crossing Vinewood	6
Napoleon st., Brush to w. line Beaubien	4
" crossing Beaubien	6
" e. line of Beaubien to Russell	4
National ave., Michigan to Grand River	6
Navarre st., McClellan to 425 ft. e. of e	6
Newark st., Twentieth to Nineteenth	6
Newberry ave., Cavalry to 341 ft. w. of Junction	6
" 341 ft. w. of to Junction	4
Newton ave., 1,264 ft. w. of to Jos. Campau	4
Newport ave., 70 ft. s. of n. of Jefferson to 397 ft. n. of same	6
Nineteenth st., Fort to Baker	4
" crossing Porter n. to s. line	6
" Baker to Newark	6
" alley w. of, 197 ft. s. of to Rose	3
Noble st., Seventh to Sixth	4
" Greenwood to 150 ft. w. of Fourth	4
" 150 ft. w. of to Fourth	3
Norton st., 283 ft. e. of to Wesson	4
" Thirty-first to 386 ft. e. of Junction	6
" 386 ft. e. of to Junction	4
N. Boulevard, 14 ft. w. of w. of Hubbard Boulevard to 10-in. main in Grand River	16
" Grand River 10-in. main to 30-in. main in Collins	24
" (n. side), 330 ft. w. of w. of Grand River to 639 ft. e. of e. of same	4
" (n. side), 1,103 ft. w. of w. of Sullivan to 100 ft. w. of same	4
" (n. side), 228 ft. w. of w. of Eighteenth	6
" (n. side), e. to w. line of Eighteenth	4
" (n. side), 5 ft. w. of w. of Woodward to 8-in. main and from 16-in. main to 3 ft. e. of e. of same	6
" (n. side), crossing Woodward between 8 and 16-in. mains	8
" (n. side), St. Aubin to 49 ft. e.	4
" (n. side), 20 ft. e. of w. of Dubois e., 174 ft	4
" (s. side), 16 ft. w. of e. of Hubbard Boulevard to 9 ft. e. of e. of Grand River	4

	LOCATION.	DIAM. INCHES.
N. Boulevard,	(s. side), 33 ft. w. of e. of Sullivan to 146 ft. e. of same	4
"	(s. side), crossing Eighteenth and Fourteenth	4
"	(s. side), 367 ft. w. of Twelfth to e. line	4
"	(s. side), crossing Greenwood, e. side	4
"	(s. side), 15 ft.w. of e.curb of Greenwood to 69 ft. e. of same	4
"	(s. side), 11 ft. e. of w. of Cass to 13 ft. e. of e. of same	4
"	(s. side), 8-in. main in Woodward to 100 ft. e. of Rivard.	4
"	(s. side), w. of w. of Chene 27 ft	4
"	(s. side), 40 ft. w. of e. of Mitchell to 64 ft. e. of e	4
Oakland ave.,	Piquette to Trombly	6
"	Milwaukee to s. line of Boulevard	4
"	s. line of N. Boulevard to 24-in. main, 87 ft	6
"	24-in. main in N. Boulevard to 27 ft. n. of s. of Horton	10
"	Horton to Hamlin	6
"	Hamlin to Sidney	10
"	Belmont to Harmon	10
"	Harmon to 130 ft. n. of Woodland	8
Orchard st.,	Trumbull to Sixth	6
"	Sixth to w. side Elton Park	4
"	e. side of Elton Park to First	4
Orleans st.,	Atwater to Jefferson	10
"	Jefferson to 100 ft. n. of n. of Wilkins	8
"	Congress to 75 ft. n. of n. of Wilkins	24
"	crossing Leland, s. side	6
"	Alexandrine to s. line of Canfield	6
"	crossing s. side of Canfield 30 ft	30
"	Garfield to 252 ft. n. of	4
"	252 ft. n. of Garfield to 195 ft. n. of Forest	6
"	Trombly to Lyman	4
Ottawa st.,	e. from Thirteenth 130 ft	8
Otis st.,	e. from Junction 300 ft	4
"	300 ft. e. of Junction to alley w. of Thirty-first	6
Owen ave.,	16-in. main in Woodward to 1,220 ft. e. of Woodward	6
Pallister ave.,	260 ft. w. of to Hamilton Boulevard	6
"	crossing w. side of Woodward	6
Palmer ave.,	Woodward to 254 ft. w. of w. of Brush	4
"	254 ft. w. of to w. line of Brush	6
"	crossing w. side of Brush	4
"	crossing e. side of Brush	6
"	crossing Beaubien and St. Antoine, n. and s. sides	4
"	crossing Hastings e. to w. lines	6
"	crossing Russell and St. Aubin	4
"	e. line of St. Aubin to 129 ft. w. of Dubois	6
"	129 ft. w. of Dubois to e. line of Grandy	4
"	Mitchell to McDougall	6
"	crossing w. side of Moran	6
"	20 ft. e. of w. of Moran to 190 ft. e. of same	4
"	190 ft. e. of e. of Moran to 300 ft. e. of same	6
"	4 ft. e. of w. of Mt. Elliott to 159 ft. e. of Meldrum	6
"	Townsend to 235 ft. e. of Baldwin	6
"	235 ft. e. of Baldwin to Van Dyke	4
"	alley s. of (or private st. n. of Ferry), 362 ft. w. to Rivard	8
"	alley s. of (or private st. n. of Ferry), crossing w. side of Rivard	4
Park ave.,	Dix to Toledo	6
"	(east of city limits), Mack to 124 ft. n. of n. of Warren	6

LOCATION.	DIAM. INCHES.
Park pl. east, Michigan to s. line of State	4
" crossing State	6
Park st., Woodward to Columbia	16
" Columbia to Bagg	8
" Bagg to Peterboro	6
" Woodward to Washington	6
Parker ave., 6 ft. n. of s. of alley n. of Jefferson to 250 ft. n. of Coe	6
" 842 ft. s. of, to 534 ft. n. of Mack	6
Parkman ave., 473 ft. w. of Seventh to Hamilton Boulevard	4
" w. line of Woodward to 16-in. main	6
Parsons st., Cass to Woodward	4
Pennsylvania ave., Jefferson to 410 ft. n. of n. of Kercheval	6
" 145 ft. s. of Mack to 50 ft. n. of Elsa	6
Perrien Park, 25 ft. w. of e. of Chene, e. 410 ft	4
Perry st., Humboldt to Eighteenth	4
" Harrison to Twelfth	6
" National to alley w. of Trumbull	4
" alley e. of Trumbull to Grand River	4
" alley s. of, alley w. of Eighth to alley w. of Sixth	4
Peterboro st., Cass to Woodward	4
Philadelphia ave., e. from Russell 389 ft	4
Pierce st., Dequindre to Jos. Campau	4
Pine st., crossing e. side of Twelfth	4
" e. line of Twelfth to National	3
" National to Grand River	4
Pitcher st., Seventh to Sixth	4
" Greenwood to 150 ft. w. of Fourth	4
" 150 ft. w. of, to Fourth	3
" alley e. of Third to Cass	4
Pingree ave., Hamilton Boulevard to Woodward	6
Piquette ave., Sullivan to Eighteenth	4
" Fourteenth to e. line of same	6
" e. line of Fourteenth to Wabash	4
" Twelfth, crossing e. side	6
" e. line of Twelfth to w. line of Avery	4
" Lincoln to Trumbull	6
" Greenwood to 124 ft. e. of e. of Fifth	6
" Woodward to Beaubien	4
" Beaubien to Russell	6
" Dubois to 186 ft. e. of e. line of same	6
" 186 ft. e. of e. of Dubois to Chene, e. line	4
" e. line of Chene to Grandy	6
" Mitchell to 32 ft. e. of e. of McDougall Boulevard	6
" 32 ft. e. of e. of Boulevard to Collins, w. line	4
" w. line of Collins to 326 ft. w. of Mt. Elliott	6
" 326 ft. w. of to Mt. Elliott	4
Pleasant ave., n. from River st. 515 ft	4
Plum st., Trumbull to alley e. of	6
" alley e. of Trumbull to Second	4
Plumer st., Livernois to Welch	4
" Wesson to 283 ft. w. of Junction	6
" 283 ft. w. of Junction to w. line of McKinstry	4
" crossing w. side of McKinstry	6
" alley s. of, alley w. of Morrell to 614 ft. w. of alley w. of McKinstry	6
" alley s. of, 614 ft. w. of, to alley w. of McKinstry	4
Pollard st., 1,242 ft. w. of, to Jos. Campau	4

	LOCATION.	DIAM. INCHES.
Poplar st.,	Twenty-fourth to 184 ft. w. of Twenty-third	6
"	184 ft. w. of Twenty-third to Tillman	4
"	Maybury to 376 ft. e. of same	4
"	51 ft. w. of Sullivan to Humboldt	6
"	w. line of Fifteenth to 110 ft. e. of Wabash	4
"	110 ft. e. of e. of Wabash to Thirteenth	6
Porter st.,	crossing Campbell	6
"	Ferdinand to McKinstry	4
"	Scotten to w. line of Hubbard	3
"	crossing Hubbard, w. side	4
"	Vinewood to e. line of W. Boulevard	6
"	e. line of W. Boulevard to Twenty-second	4
"	22 ft. e. of w. of Twenty-second to 20 ft. w. of e. of Twentieth	8
"	20 ft. w. of e. of Twentieth to 30 ft. w. of e. of Fourteenth	10
"	e. from Fourteenth 172 ft	3
"	Thirteenth to 210 ft. w. of Twelfth	4
"	210 ft. w. of to Twelfth	3
"	31 ft. w. of e. of Fourteenth to 9 ft. w. of w. of Tenth	12
"	alley s. of, 8 ft. w. of e. of Thirteenth to 23 ft. e. of e. of same	4
"	alley s. of, 23 ft. e. of e. of Thirteenth to alley e. of same	3
"	alley s. of, Twelfth to First	4
Prentiss ave.,	Greenwood to alley w. of Fourth	4
"	Third to Cass	4
"	alley s. of, from Second e. 150 ft	3
Preston st.,	McDougall to Mt. Elliott	4
Private road,	private way (e. of Russell), s. from Clay 405 ft	4
Pulford ave.,	Gratiot to Mt. Elliott	4
"	Meldrum to Beaufait	4
Putnam ave.,	Fourteenth to Wabash	4
"	w. line of Thirteenth to 185 ft. w. of Twelfth	4
"	185 ft. w. of, to Twelfth	3
"	Twelfth to Trumbull	4
"	Lincoln to Fourth	4
"	Third to 323 ft. e. of same	4
"	323 ft. e. of Third to alley w. of Second	6
"	318 ft. w. of to Cass (n. lawn)	6
"	5 ft. e. of w. of alley e. of Second to w. line of Cass (s. lawn)	6
"	w. line of Cass to 60 ft. w. of Woodward	4
"	60 ft. w. of to Woodward	6
Railway ave.,	Scotten to La Salle	6
Randall st.,	crossing w. side of Twenty-third 26 ft	4
Randolph st.,	alley s. of Atwater to Jefferson	4
"	Atwater to 24-in. main in Cadillac square	8
"	Larned to Congress	4
"	Congress to s. line of Gratiot	6
"	crossing Gratiot	10
"	Gratiot to Adams	6
"	alley e. of, alley s. of Fort to Champlain	4
"	alley e. of, alley s. of Macomb to Gratiot	4
Ranspach st.,	Livernois to Hammond	4
Raynor st.,	Clinton to Gratiot	4
Reed pl.,	335 ft. w. of to Greenwood	4
"	Greenwood to 36 ft. w. of Fourth	3
"	36 ft. w. of to Fourth	4

LOCATION.	DIAM. INCHES.
Reeder ave., 438 ft. w. of Campbell to Junction	4
Regular ave., Military to Cavalry	6
Reservoir grounds, n. of basin to 30-in. branch	24
" s. and w. sides of basin	24
Rich st., Twenty-eighth to Clark	6
" Clark to Scotten	4
" Vinewood to 204 ft. e. of same	4
" 204 ft. e. of Vinewood to Twenty-seventh	6
Riopelle st., Atwater to Jefferson	8
" Jefferson to Larned	12
" Larned to Adelaide	8
" Adelaide to 218 ft. n. of Hancock	6
" Frederick to Kirby	6
" alley e. of, Willis to Canfield	4
" alley e. of, Garfield to 233 ft. n. of same	4
" alley e. of, 233 ft. n. of Garfield to alley s. of Hancock	6
Rivard st., Atwater to Jefferson	8
" Jefferson to Clinton	10
" Clinton to 9 ft. s. of Mullett	6
" Mullett to Gratiot	10
" Gratiot to Watson	4
" Eliot to 90 ft. s. of Warren	4
" 90 ft. s. of Warren to 21 ft. n. of s. of Farnsworth	6
" 21 ft. n. of s. of Farnsworth to 36 ft. n. of s. of Kirby	16
" Kirby to 221 ft. n. of Palmer	4
" 221 ft. n. of Palmer to alley n. of Harper	6
" crossing Piquette	4
" 5 ft. s. of, to 153 ft. n. of N. Boulevard	6
" 153 ft. n. of N. Boulevard to Clay	4
" n. from Clay 1,178 ft	6
" Larned to Congress	4
River st., 55 ft. w. of w. of Dearborn to w. line of city limits	6
" w. line of city limits to Campau	6
" Campau to Pleasant	8
" Pleasant to 75 ft. e. of Swain	6
" 525 ft. w. of Twenty-fourth to w. side of M. C. R. R. tracks	8
" crossing M. C. R. R. from w. to e. side 270 ft	6
" e. side of M. C. R. R. tracks to Sixth st	8
" Sixth to Fifth and Fourth to Third	4
" alley s. of, Third to Second	4
Roby st., n. from Ferry 325 ft	4
Rohns ave., Goethe to 1,283 ft. n. of n. of Mack	6
" 360 ft. s. of Chapin to 800 ft. s. of Gratiot	8
" 800 ft. s. of Gratiot to Harper	6
Rolfe pl., 22 ft. s. of n. of Mack to 521 ft. n. of same	6
Rollin st., 41 ft. w. of e. of Wesson to 336 ft. e. of e. of same	6
Romeyn st., Cavalry to Campbell	6
" Campbell to Junction	4
Rose st., Twentieth to Eighteenth	4
Rosedale ave., 16-in. main to e. line of Woodward	6
" e. line of Woodward to w. line of Oakland	4
" w. line of to Oakland	6
Rowena st., Woodward to 23 ft. e. of w. of John R.	4
" 23 ft. e. of w. of John R. to 23 ft. e. of w. of Brush	8
" 23 ft. e. of w. of Brush to Riopelle	4
Rowland st., 24-in. main in Michigan to Grand River	8

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LOCATION.	DIAM. INCHES.
Russell st., Larned to n. line of Congress	6
" Congress to Macomb	8
" Mullett to Watson	8
" Watson to Canfield	6
" Canfield to s. line of Hendrie	10
" s. line of Hendrie to s. line of Piquette	8
" s. line of Piquette to Alger	6
" alley e. of, Chase to Fort	4
" alley e. of, Willis to 220 ft. n. of same	4
St. Albertus pl., 22 ft. e. of Dequindre to 260 ft. w. of St. Aubin	4
" 260 ft. w. of to St. Aubin	3
St. Antoine st., Atwater to Congress	8
" Congress to s. line of Champlain	6
" crossing Champlain	8
" n. line Champlain to n. line of Gratiot	6
" Jefferson to Congress	4
" Catherine to Elizabeth	12
" Elizabeth to Adelaide	6
" Adelaide to Watson	8
" Watson to n. line of Farnsworth	6
" crossing Frederick and Palmer	6
" s. line Medbury to s. line of N. Boulevard	6
" crossing N. Boulevard s. side to 24-in. main	8
" alley e. of N. Boulevard to Custer	3 & 4
St. Aubin ave., Atwater to 22 ft. n. of n. of Harper	6
" 22 ft. n. of n. of Harper to Trombly	8
" Trombly to 27 ft. n. of s. of Clay	10
" Clay to 22 ft. n. of Danforth	6
" Larned to Congress	12
" Congress to Champlain	36
" alley e. of Kirby to Palmer	4
St. Clair ave., 602 ft. s. of Jefferson to 8-in. main in Jefferson	4
St. Clair pl., Nineteenth to alley w. of Eighteenth	4
St. Joseph st., Russell to Riopelle	3
" e. line of Riopelle to 310 ft. e. of St. Aubin	4
" 310 ft. e. of St. Aubin to w. line of Chene	3
" crossing Chene	4
" e. line of Chene to 202 ft. e. of same	3
" 202 ft. e. of Chene to Grandy, w. line	4
" w. line of Grandy to 18 ft. e. of w. of Jos. Campau	6
" w. line of McDougall to w. line of Collins	3 & 4
" w. line of Collins e. 188 ft	6
St. Paul ave., Bellevue to e. line of Concord	4
" crossing Frontenac Boulevard	6
" e. line of Frontenac Boulevard to e. line of Field	4
" Townsend to Baldwin	4
" Iroquois to Burns	6
" Crane to alley w. of same	4
" Holcomb to Belvidere	6
Sargent st., St. Aubin to 6 ft. e. of D., G. H. & M. R. R	6
" crossing Collins	6
Savoy st., Twenty-fourth to Twenty-third	4
" Twenty-second to Twenty-first	4
Schiller st., e. from McClellan 245 ft	4
Schiller Boulevard, (n. and s. sides), at w. line of Woodward 8 ft	4
Schneider pl., e. from Ellery 105 ft	6
" 105 ft. e. of Ellery to Mt. Elliott	4

LOCATION.	DIAM. INCHES.
Scott st., Riopelle to e. line of St. Aubin	4
“ e. line of St. Aubin to Dubois	3
“ crossing Dubois to 156 ft. e. of same	4
“ 156 ft. e. of Dubois to 499 ft. e. of Chene	3
“ 499 ft. e. of Chene to Jos. Campau	4
“ Orleans to Chene	30
Scotten ave., Fort to Dix	6
“ Dix to Buchanan (s.)	8
“ Buchanan (s.) to Buchanan (n.)	16
“ Buchanan to McGraw	6
Scovel pl., crossing W. Boulevard to 24 ft. e of same	6
“ 25 ft. w. of e. of Twenty-sixth to 203 ft. e. of same	6
“ in Mound “Eckstrom” 50 ft	4
Sears ave., Holcomb to 193 ft. e. of McClellan	4
Second st., Front to Woodbridge	6
“ Woodbridge to alley n. of Jefferson	10
“ crossing Congress	10
“ Abbott to alley s. of same	8
“ Abbott to Grand River	10
“ alley w. of, Front to alley n. of same	4
“ alley w. of, alley s. of to Lewis	4
Second ave., High to 166 ft. n. of Henry	4
“ Grand River to Bagg	10
“ Bagg to s. line of Canfield	6
“ crossing Canfield s. line to 20 ft. s. of n.	8
“ 20 ft. s. of n. to 30 ft. n. of Prentiss	6
“ (e. side) 16 ft. s. of n. of Forest to 17 ft. s. of n. of Hancock	6
“ crossing Forest s. line to 22 ft. n. of n. line	6
“ (e. side) crossing Putnam and Merrick	6
“ (w. side) crossing Putnam and Merrick	4
“ 36 ft. s. of n. of Kirby to 2 ft. n. of n. of Colburn	6
“ 24 ft. s. of n. of Colburn to s. line of N. Boulevard	6
“ crossing N. Boulevard	8
“ alley w. of, Forest to 28 ft. n. of s. of Merrick	6
“ alley e. of, alley n. of Canfield to Prentiss	4
“ alley e. of, 28 ft. n. of s. of Warren to 16 ft. n. of s. of Putnam	6
Secor pl., from Ferry to 267 ft. s. of s.	4
Selden ave., Seventh to Sixth	4
“ crossing Greenwood	4
“ Greenwood to alley w. of Fourth	3
“ alley w. of to Fourth	4
“ Third to Woodward	4
“ alley s. of, Greenwood to alley w. of Fourth	4
Seminole ave., 21 ft. s. of n. of Agnes to n. line of St. Paul	6
“ alley e. of, 6 ft. n. of s. of alley n. of Jefferson to n. line of Champlain	4
“ alley e. of, n. line of Champlain to 21 ft. s. of n. of Agnes	6
Seventh st., River st. to alley n. of Lafayette	8
“ alley n. of Lafayette to Bagg	10
“ Bagg to Grand River	8
“ Grand River to Calumet	6
“ crossing Calumet s. to n. line	8
“ n. line of Calumet to 684 ft. n. of Stanley	6
“ alley w. of, alley s. of to Spruce	3

LOCATION.	DIAM. INCHES.
Seventh st., alley w. of, alley s. of to Perry	4
Seventeenth st., Fort to Poplar	6
" Poplar to s. line of Buchanan	4
" s. line of Buchanan to Warren	6
Seward ave., 184 ft. w. of Hamilton Boulevard to Woodward	6
Seyburn ave., Jefferson to n. line of Agnes	6
" 462 ft. s. of to Gratiot	6
Shady lane, crossing W Boulevard	4
" crossing Vinewood	6
Shakespeare Boulevard, (n. and s. sides) at w. line of Woodward 9 ft.	4
Shelby st., Atwater to Woodbridge	6
" Woodbridge crossing n. side	8
" n. line of Woodbridge to Michigan	10
" Lafayette to alley s. of Michigan	4
Sheridan ave., Jefferson to 35 ft. s. of n. of Waterloo	6
" Mack to Gratiot	6
" Gratiot to 18 ft. n. of Ferry	8
Sherman st., Hastings to Elmwood	4
" Russell to Orleans	8
" crossing Jos. Campau w. to e. line	6
Shipherd ave., Champlain to 221 ft. n. of n.	6
" n. from Florene 169 ft.	6
Sibley st., Clifford to Woodward	4
Sidney ave., 16-in. main in Woodward to Oakland	6
" Russell to 779 ft. e. of	4
Sixth st., River st. to Congress	16
" Congress to Abbott	24
" River st. to alley n. of	4
" Abbott to Cherry	6
" Cherry to 47 ft. s. of Bagg	12
" 47 ft. s. of Bagg to 24-in. main	16
" n. from Bagg to Grand River	8
" Grand River to 473 ft. n. of	4
" 473 ft. n. of Grand River to Calumet	6
" crossing Calumet	8
" n. line of to 20 ft. n. of Calumet	6
" 20 ft. n. of n. of Calumet to 265 ft. n. of Lysander	4
Sixteenth st., Lafayette to Myrtle	6
" Myrtle to Buchanan	8
" Buchanan to Grand River	10
" Grand River to McGraw	8
" s. from 24-in. main in N. Boulevard 63 ft.	8
" alley w. of, Lafayette to Howard	3
Smith ave., Woodward to 3 ft. w. of w. of Oakland	4
" 3 ft. w. of w. of to 25 ft. e. of w. of Oakland	6
South st., Grand River to Noble	4
Southern ave., Livernois to 152 ft. e. of same	4
Spencer st., Second to Cass	4
" alley s. of, alley e. of Second to First	4
" alley s. of, e. of First to Cass	4
Sproat st., Cass to Woodward	4
Spruce st., Thirteenth to Twelfth	6
" Twelfth to Harrison	4
" National to alley w. of Trumbull	4
" alley w. of to Seventh	3
" Seventh to Fifth	4

LOCATION.	DIAM. INCHES.
ce st., alley s. of, from second alley w. of to first alley w. of Seventh	3
dish st., Twentieth to Foundry	6
nley ave., Tillman to Williams	6
" Grand River to Sullivan	6
" crossing Humboldt, w side	4
" 25 ft. w. of e. of Humboldt to 2 ft. e. of e. of Eighteenth	6
" Stanton to Sixteenth	6
" crossing Fourteenth	6
" 183 ft. w. of to Twelfth	4
" Commonwealth to Seventh	4
" Seventh to Greenwood	6
tanton ave., Merrick to Antoinette	6
" crossing N Boulevard	6
tark ave., Livernois to Welch	4
tate st., Cass to Woodward	10
" crossing Washington e. side 24 ft	24
" 80 ft. w. of e. of Washington to Woodward	30
" alley s. of, from Cass to alley w. of Washington	4
" alley s. of, from alley e. of Washington to e. line of Griswold	4
" alley s. of, e. line of Griswold to alley w. of Woodward	8
Stevens ave., 26 ft. n. of s. of Gratiot to 366 ft. n. of same	6
Stimson pl., Cass to Woodward	4
Stewart st., Bellevue to Canton	6
Sullivan ave., Michigan to 463 ft. n. of Buchanan	6
" crossing Warren	6
" 25 ft. s. of n. of Stanley to Baltimore	6
" crossing N Boulevard	8
Summit ave., River st. to Fort	6
Superior st., crossing Brush	4
" 3 ft. e. of e. of Brush to 220 ft. w. of Beaubien	6
" 220 ft. w. of to Beaubien	4
" Beaubien to Russell	6
" Riopelle to Dequindre	4
" Dequindre to St. Aubin	6
" crossing e. side of St. Aubin	4
" St. Aubin to w. line of Chene	3
" crossing Chene	4
" e. line of to 343 ft. e. of Chene	3
" 343 ft. e. of Chene to Mitchell	4
" McDougall to Gratiot	4
Swain ave., 40 ft. s. of Wabash R. R. to Fort	6
Sycamore st., Wabash to Harrison	4
" National to alley w. of Trumbull	4
" 123 ft. w. of to Grand River	6
Sylvan st., Vinewood to 65 ft. e. of same	4
" 65 ft. e. of Vinewood to 105 ft. w. of Twenty-seventh	6
" 105 ft. w. of to Twenty-seventh	4
Sylvester st., Gratiot to Mt. Elliott	4
" Beaufait to Concord	4
Taylor ave., 2 ft. w. of e. of Hamilton Boulevard to 16-in. main in Woodward	6
Tenth st., River st. to Abbott	8
" Abbott to Michigan	24
Theodore st., John R. to 106 ft. e. of Riopelle	4
" 268 ft. w. of St. Aubin to w. line of Dubois	4

LOCATION.	DIAM. INCHES.
Theodore st., crossing Dubois	6
" e. line of Dubois to Grandy	4
" 11 ft. e. of w. of Jos. Campau to 27 ft. w. of e. of McDougall	6
" crossing Collins	6
" crossing Moran w. side	6
" e. from Moran 375 ft	4
" crossing Mt. Elliott main to main	6
" 15 ft. w. of e. of Mt. Elliott to w. line of Beaufait	4
" Helen to 191 ft. e. of same	6
" alley s. of, e. and w. of Davis pl. 150 ft	4
Third st., Front to s. line of River st	6
" s. line of River st. to Larned	8
" Larned to alley n. of	6
" Larned to Fort st.	24
" Abbott to High	6
" alley e. of, alley n. of Michigan to Lewis	4
Third ave., Grand River to Bagg	8
" Bagg to Calumet, s. line	6
" s. to n. line of Calumet	8
" n. line of Calumet to Holden, n. line	6
" crossing Baltimore	6
" Calumet to Canfield	30
" alley e. of, from Henry to Brainard	4
Thirteenth st., River st. to Fort	4
" Fort to Howard	6
" alley s. of Porter to Porter	4
" Porter to Ash	6
" crossing Myrtle	6
" Magnolia to n. line of Grand River	6
" n. line of Grand River to 15 ft. n. of Canfield	4
" 15 ft. n. of Canfield to Hancock	6
" Hancock to 150 ft. n. of	4
" 150 ft. n. of Hancock to 20 ft. n. of s. of Kirby	6
" 25 ft. n. of s. of Harper to 210 ft. n. of n. of same	6
" alley w. of, Bagg to Myrtle	6
Thirtieth st., 30 ft. s. of Jackson to Buchanan	6
" Devereaux to 153 ft. s. of Warren	6
Thirty-first st., Michigan to 250 ft. s. of Warren	6
" 150 ft. s. of to Norton	6
Thirty-second st., Michigan to 15 ft. s. of Buchanan	4
" 15 ft. s. of to 85 ft. n. of Buchanan	6
" 85 ft. n. of to 385 ft. n. of Buchanan	8
" 385 ft. n. of Buchanan to 82 ft. n. of Horatio	6
Thirty-third st., Michigan to Horatio	6
Thirty-fourth st., Michigan to 136 ft. n. of Jackson	8
" 64 ft. s. of to 132 ft. n. of Buchanan	8
" 132 ft. n. of Buchanan to 126 ft. n. of Rich	6
Thirty-fifth st., Michigan to n. line of Buchanan	6
" n. line of Buchanan to 277 ft. n. of n. of Rich	8
Thompson ct., n. of Forest 115 ft	4
Tillman ave., Michigan to 300 ft. n. of Merrick	6
" Hudson to McGraw	6
Toledo ave., Livernois to McKinstry	6
" McKinstry to 360 ft. e. of Scotten	4
" 360 ft. e. of Scotten to Hubbard	6
" w. line of W. Boulevard to Twenty-fifth	6

LOCATION.	DIAM. INCHES.
Tonti st., Van Dyke to Maxwell	6
Torrey st., Twenty-eighth to Lovett	4
" crossing w. side of Scotten	4
Townsend ave., Jefferson to 36 ft. n. of s. of Waterloo	6
" n. from Mack 208 ft	6
" 208 ft. n. of Mack to s. line of Gratiot	4
" s. line of to 8-in. main in Gratiot	8
" 8-in. main in Gratiot to n. line of Palmer	6
Trombly ave., Oakland to Hastings	6
" Crystal to Russell	4
" Russell to 20 ft. e. of w. of Dubois	8
" 183 ft. w. of to Chene	6
" Chene to w. line of Collins	4
" crossing Collins	6
" e. line of Collins to 72 ft. e. of Ellery	4
" 72 ft. e. of Ellery to e. line of Mt. Elliott	6
Trowbridge ave., 16-in. main to e. line of Woodward	6
" e. line of to 511 ft. e. of Woodward	4
Trumbull ave., 21 ft. s. of n. of Fort to 9 ft. n. of s. of alley s. of Abbott	8
" 9 ft. n. of s. of alley s. of Abbott to 24-in. main in Abbott	10
" Abbott 24-in. main to 8-in. main in Michigan	8
" Michigan to Plum	6
" Grand River to alley n. of	6
" Calumet to Forest	8
" Forest to 497 ft. n. of G. T. R. R.	6
" 497 ft. n. of G. T. R. R. to 50 ft. n. of Piquette	8
" 50 ft. n. of Piquette to Holden	6
" alley w. of, Cherry to Pine	3
" alley w. of, Pine to Myrtle	4
" alley w. of, alley n. of Grand River to Calumet	6
" alley e. of, Plum to Sycamore	6
Tuscola st., Fourth to Third	6
" alley s. of, Greenwood to alley w. of Fourth	4
Twelfth st., 458 ft. s. of to River st	4
" 17 ft. s. of n. of River st. to 31 ft. s. of n. of Lafayette	8
" 26 ft. s. of n. of Howard to 25 ft. s. of n. of Baker	8
" Baker to Calumet	6
" Calumet to s. line of Boulevard	8
" s. line of to 16 ft. s. of n. line of Boulevard	10
" alley w. of, from 121 ft. s. of to Porter	4
" private alley e. of, from 12-in. main in Porter to alley n. of	4
Twentieth st., Fort to Michigan	6
Twenty-first st., Fort to Standish	4
" crossing Porter s. to n. line	6
" alley w. of, Brevoort to Webster	4
Twenty-second st., Fort to Dalzelle	6
Twenty-third st., Fort to Magnolia	6
" Magnolia to 35 ft. s. of Linden	3
" 35 ft. s. of Linden to 100 ft. n. of Poplar	4
" 100 ft. n. of Poplar to Kirby	6
" Kirby to s. line of McGraw	4
" s. line of McGraw to Ivy pl	6
Twenty-fourth st., River st. to Fort	4
" Fort to Baker	6

LOCATION.	DIAM. INCHES.
Twenty-fourth st., Baker to s. line of Michigan	8
" s. line of to 52 ft. n. of Michigan	16
" 52 ft. n. of to 138 ft. n. of Michigan	18
" 138 ft. n. of to 192 ft. n. of Michigan	20
" 192 ft. n. of Michigan to Butternut	24
" Butternut to Buchanan	10
" Buchanan to n. line of McGraw	8
" n. line of McGraw to Chope pl	6
Twenty-fifth st., Howard to Baker	4
" Baker to Toledo	6
" E st. to Michigan	4
" Michigan to Hancock	6
" crossing Warren	6
" 125 ft. s. of Hudson to n. line of McGraw	6
Twenty-sixth st., 213 ft. s. of E st. to 146 ft. s. of Hancock	6
" 146 ft. s. of to 421 ft. n. of Hancock	8
" 421 ft. n. of Hancock to McGraw	6
" 24 ft. n. of s. of Brown pl. to 36 ft. n. of s. of Grand River	6
Twenty-seventh st., Myrtle to s. line of Buchanan	6
" crossing Buchanan	8
" n. line of Buchanan to 32 ft. n. of s. of McGraw	6
Twenty-eighth st., Michigan to 14 ft. n. of Rich	6
Twenty-ninth st., 565 ft. s. of Michigan to Buchanan	6
Union st., Fifth to Fourth	3
Uthes st., McKinstry to Clark	4
Van Dyke ave., Jefferson to 150 ft. n. of Waterloo	8
" 276 ft. s. of n. line of to n. line of Worcester	8
" n. line of Worcester to Mack	6
" Mack to n. line of Gratiot	8
" Gratiot to Harper	6
" Jefferson connecting with 42-in. main 22 ft. of	10
Vincennes st., McClellan to 172 ft. e. of e. of same	6
Vine st., crossing e. side of Fifth	4
" Fifth to Fourth	3
Vinewood ave., Fort to Buchanan	24
" Buchanan to Merrick	10
" Merrick to Grand River	8
" Fort to 430 ft. n. of Toledo	6
" F st. to Buchanan	6
" crossing Vinewood s. of M. C. R. R. between mains 22 ft.	6
Virginia ave., Hamilton Boulevard to w. line of Woodward, n. and s. sides	4
" 5 ft. e. of w. line of to 16-in. main in Woodward	6
Visger st., Twenty-eighth to Lovett	6
" crossing e. side of Scotten	6
" La Salle to Vinewood	6
Wabash ave., n. line of M. C. R. R. to n. line of Ottawa	6
" n. line of Ottawa to s. line of Buchanan	4
" s. line of Buchanan to s. line of Grand River	8
" crossing Grand River	6
" n. line of Grand River to 18 ft. s. of s. line of L. S. & M. S. R. R.	8
" 18 ft. s. of s. of L. S. & M. S. R. R. to 186 ft. n. of Piquette	6
" crossing N. Boulevard	6

LOCATION.	DIAM. INCHES.
Walbridge st., Baldwin to Van Dyke	6
Walker st., Atwater to Jefferson	4
Walnut st., 264 ft. w. of to Van Dyke	6
Warren ave., w. line of Scotten to Grand River	6
" Sixteenth to Fourteenth	4
" 35 ft. e. of w. of Fourteenth to 7 ft. e. of e. of alley e. of same	6
" 7 ft. e. of e. of alley e. of Fourteenth to Avery	4
" 195 ft. w. of to Twelfth, n. side	4
" Trumbull to 106 ft. w. of Seventh	6
" 106 ft. w. of Seventh to Greenwood	4
" Greenwood to Third	6
" Third to Cass	8
" 6 ft. e. of w of Cass to 105 ft. e. of Riopelle	4
" Warren ct. to w. line of Dubois	4
" crossing Dubois 56 ft	6
" e. line of Dubois to e. line of Grandy	4
" 12 ft. e. of w. of to 10 ft. w. of e. of Jos. Campau	6
" crossing Collins	6
" w. line of Moran to 63 ft. e. of Detloff ct	6
" 2 ft. e. of w. of Mt. Elliott to 178 ft. e. of e. of same	6
" Helen to 228 ft. e. of same	4
Warren ct., 181 ft. s. of to 56 ft. n. of Warren	4
Warsaw pl., 17 ft. e. of Dequindre to St. Aubin	6
Washington ave., Michigan to State	30
" Michigan to Park	10
" alley w. of, from alley s. of State to alley s. of Bagley	4
" alley e. of, from alley s. of State to alley w. of Woodward	4
Waterloo st., Dequindre to Jos. Campau	4
" Jos. Campau to Burlage pl	6
" Burlage to Mt. Elliott	8
" Mt. Elliott to 56 ft. e. of Beaufait	4
" 56 ft. e. of Beaufait to Bellevue	6
" Field to Sheridan	6
" Townsend to Baldwin	6
Watson st., Woodward to Brush	4
" Brush to reservoir	24
" Dequindre to Chene	4
Wayne st., 173 ft. s. of to Woodbridge	4
" Woodbridge to Michigan	6
Webster pl., Twenty-second to alley e. of same	6
" Nineteenth to alley w of Eighteenth	4
Webb ave., e. line of Hamilton Boulevard to w. line of Woodward	4
" w. line of Woodward to 16-in. main	6
Welch ave., Plumer to s. line of M. C. R. R	6
" 211 ft. s. of to 309 ft. n. of Stark	6
" s. line of Ingersoll to n. of city limits	6
Wesson ave., Toledo to Herbert	6
W. Boulevard, (both sides) Fort to Shady lane	4
" (west driveway) Shady lane to Baker	3
" (w. side) 18 ft. s. of n. of Shady lane to 33 ft. s. of n. of Baker	4
" (w. side) n. line of Dix to n. line of Toledo	4
" (w. side) E st. to 444 ft. s. of Michigan	6
" (w. side) 444 ft. s. of to s. line of Michigan	4

LOCATION.	DIAM. INCHES.
W. Boulevard, (w. side) s. line of Michigan to Myrtle	6
" (e. side) 19 ft. s. of n. of Shady lane to 196 ft. n. of Toledo	6
Western Hay Market, 171 ft. w. of to Trumbull	3
Westminster ave., 16-in. main to 1,222 ft. e. of Woodward	6
Whipple st., Baldwin to Van Dyke	4
Whiting ave., Jos. Campau to 1,880 ft. e. of same	4
Widman pl., Harper to Milwaukee	6
Wight st., Chene to McDougall	4
" McDougall to Mt. Elliott, w. line of	10
" w. line of Mt. Elliott to 110 ft. e. of Meldrum	6
" alley s. of, from McDougall to 230 ft. e. of same	4
Wilcox st., Woodward to Miami	12
Wilkins st., Brush to Russell	4
" 158 ft. w. of Riopelle to Orleans	4
" Orleans to 30-in. main in Chene	8
Willard st., Van Dyke to 255 ft. e. of same	4
Williams ave., Michigan to Hancock	6
" crossing Warren	6
" Merrick to Hudson	6
" Stanley to McGraw	6
Willis ave., crossing e. side of Twelfth	4
" e. line of Twelfth to Avery	6
" Eighth to Sixth	4
" Greenwood to Fourth	4
" Fourth to Woodward	6
" Woodward to Beaubien	4
" Beaubien to St. Antoine	3
" St. Antoine to Hastings	6
" Hastings to 356 ft. e. of same	4
" 356 ft. e. of Hastings to Rivard	8
" Rivard to Russell	6
" Russell to e. line Chene	4
" e. line of Chene to Grandy	3
" Jos. Campau to Collins	6
" Collins to 162 ft. e. of same	4
" 162 ft. e. of Collins to Moran st. main	6
" from main in Moran to alley w. of Mt. Elliott	4
" alley s. of, from 20 ft. n. of s. of Willis to alley w. of Avery	4
Winder st., Woodward to w. line of Beaubien	4
" crossing Beaubien	6
" e. line of Beaubien to Orleans	4
Wing pl., Nineteenth to alley w. of Eighteenth	4
Winslow ave., Grand River to 85 ft. n. of same	4
" 85 ft. n. of Grand River to McGraw	6
Winter st., Dequindre to 431 ft. e. of same	4
Witherell st., Woodward to Miami	16
" Woodward to Miami	6
" Miami to Adams	4
" Adams to alley s. of Elizabeth	3
" alley s. of Elizabeth to Columbia	6
Wolff st., Scotten to 357 ft. e. of same	4
Woodbridge st., Second to First	6
" First to Griswold	4
" Griswold to 24 ft. e. of w. of Woodward	6

	LOCATION.	DIAM. INCHES.
Woodbridge st.,	24 ft. e. of w. of Woodward to 6 ft. e. of e. line of St. Antoine	8
"	6 ft. e. of e. line of St. Antoine to Dubois	6
"	300 ft. w. of to Jos Campau	6
"	Jos. Campau to 400 ft. e. of same	4
"	400 ft. e. of Jos. Campau to McDougall	6
"	325 ft. w. of to Leib	4
"	alley s. of, Bates to Randolph	4
"	alley s. of, Brush to 210 ft. e. of Beaubien	4
"	alley s. of, McDougall to Walker	4
Woodland ave.,	16-in. main to e. line of Woodward	6
"	e. line to 780 ft. e. of Woodward	4
Woodward ave.,	(e. side) s. from Atwater to 246 ft.	3
"	(e. side) Milwaukee to 102 ft. s. of N. Boulevard	6
"	(e. side) 102 ft. s. of to N. Boulevard	4
"	(e. side) crossing s. side of Melbourne	6
"	(e. side) crossing Chicago Boulevard	6
"	(e. side) crossing Boston Boulevard	6
"	(w. side) from 171 ft. s. of to Atwater	4
"	(w. side) crossing Virginia ave.	6
"	(w. side) crossing Shakespeare Boulevard	6
"	(w. side) crossing Schiller Boulevard	6
"	Atwater to Jefferson	16
"	Jefferson to Soldiers' Monument	24
"	Bagg to Edmund	24
"	Atwater to Adams	8
"	Adams to Baltimore	10
"	Baltimore to Clay	8
"	N. Boulevard to Woodland	16
"	Woodland to 15 ft. n. of city limits	12
"	High to 200 ft. n. of Canfield	4
"	alley e. of, alley s. of Atwater to alley s. of Jefferson	4
"	alley e. of, alley s. of Larned to alley s. of Cadillac square	4
"	alley e. of, alley s. of to Gratiot	6
"	alley e. of, Gratiot to 12 ft. s. of n. of John R.	8
"	alley e. of, 12 ft. s. of n. of John R. to 172 ft. s. of Witherell	6
"	alley e. of (private alley), 80 ft. s. of to Witherell 97 ft.	3
"	alley e. of, alley s. of Elizabeth to s. line of Elizabeth	3
"	alley e. of, crossing s. side of Elizabeth	4
"	alley e. of, Elizabeth to Columbia	6
"	alley e. of, Columbia to Montcalm	4
"	alley w. of, Atwater to alley s. of Jefferson	4
"	alley w. of, alley s. of Larned to alley s. of Fort	8
"	alley w. of, alley s. of State to Clifford	8
"	alley w. of, crossing n. side of Clifford	6
"	alley w. of, n. line of Clifford to alley s. of Park	4
"	alley w. of, Montcalm to High	3
Woodward ave. terrace,	Woodward to w. line of John R.	4
Wreford pl.,	crossing w. side of Vinewood	6
"	crossing Hubbard Boulevard	6
Wreford ave.,	Grand River to Eighteenth	4
Zender pl.,	Ellery to 288 ft. e. of same	6
"	288 ft. e. of Ellery to Mt. Elliott	4

J. B. Davis

FORTY-THIRD

ANNUAL REPORT

OF THE

BOARD OF WATER COMMISSIONERS

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COMMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR

1894.

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FORTY-THIRD ANNUAL REPORT

OF THE

troit Board of Water Commissioners

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1894.

DETROIT:
THE DETROIT FREE PRESS PRINTING COMPANY.
1895.

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BOARD OF WATER COMMISSIONERS.

DETROIT, 1894-95.

MEMBERS:

HENRY M. DUFFIELD, 1895. FRANK E. KIRBY, 1896.
ALBERT L. STEPHENS, 1897. DEWITT H. MORELAND, 1898.
EDWARD W. PENDLETON, 1899.

COMMITTEES:

WAYS AND MEANS	Commissioners STEPHENS, PENDLETON.
EXTENSION AND CONSTRUCTION	Commissioners MORELAND, KIRBY.
PUMPING WORKS	Commissioners KIRBY, STEPHENS.
SUPPLIES	Commissioners PENDLETON, MORELAND

OFFICERS:

PRESIDENT	HENRY M. DUFFIELD.
VICE-PRESIDENT	FRANK E KIRBY.
GENERAL SUPERINTENDENT	L. N. CASE.
SECRETARY	
CIVIL ENGINEER	G. S. WILLIAMS.
SUPT. OF EXTENSION	HENRY BRIDGE.
SUPT. OF METERS AND INSPECTION	THOMAS R. PUTNAM.
SUPT. OF GROUNDS	E. A. SCRIBNER.
CHIEF ENGINEER	URIAH GOULD.
FIRST ASSISTANT ENGINEER	THOMAS SPACKMAN.
CONSULTING ENGINEER	JOHN E. EDWARDS.
METER CLERK	HARRY S. STARKEY.
ASSESSORS AND COLLECTORS	FRED. H. HUTAFF. W. W. WILCOX. JOHN J. ROBINSON. PETER J. BECKER. THOS. W. GOODALE. ANTHONY VOGEL. CHARLES J. PATERSON. GEORGE A. WINSLOW.
RECEIVING CLERK	GEORGE E. KUNZE.
PERMIT CLERK	JOHN E. LONG.
PURCHASING AGENT	THOMAS E. LYNCH.
AUDITOR	J. A. M. MORETON.

DETROIT WATER WORKS.

METER RATES.

First 3,000 Cubic Feet, each month, each 100 gallons	⅔ of a cent.
All over, each 100 gallons	⅓ of a cent.

ASSESSMENT RATES.

FROM JULY 1st, 1886.

	PER ANNUM
For Family, household purposes	$5 00
Each Additional Family in same house, supplied with one faucet	3 00
Green Houses.—Special rates.	
Private Stables, for each horse	2 00
Livery Stables, " " "	2 00
Dray and Team Horses, each	1 00
Cows, each	1 00
Stores and Offices	$2 00 to 20 00
Bakeries, average daily use, for each barrel of flour	3 50
Saloons, Groceries and Provision Stores, from	$3 00 to 100 00
Bar, with faucet, from	8 00 to 50 00
Fish Houses	10 00 to 100 00
Slaughter Houses.—Special rates.	
Hotels and Taverns, in addition to family rate, each room	1 00
Boarding Schools, each room	1 00
Public Schools, from	$5 00 to 50 00
Building Purposes, each 1 M brick	5
" " " 100 yards plastering	10
" " " perch stone	1½
Printing Offices.—Special rates.	
Butcher Stalls, each not less than	3 00
Workshops, for 10 persons or under	3 00
" for each additional 10 persons	1 00
Estimated quantities of water each 100 gallons	2
Boarding Houses, in addition to family rate, each boarder	1 00

FIXTURES.

Bath Tubs, for families, 1st tub, $2; each additional	$1 00
Bath Tubs, public, each tub	5 00
Water-closets, for a family, 1st closet, $3 00; each additional, $1 00	$3 00 to 15 00
Water-closets, for Hotels, Stores, Factories, etc., for ten persons, $5 00; each additional person	25
Rod Water-closets, not less than	6 00
Urinals, not less than	2 00
Wash-Hand Basins, for family	$1 00 to 3 00
" " " for other purposes, each person	25
Permanent Wash Tubs	*No Charge.*
Hose, for lawn and street sprinkling purposes	*free.*
Hose, for other purposes	$3 00 to 30 00
Fountains	5 00 to 20 00
Street Sprinklers, each wagon	150 00

Where there is a waste of water a proper increase of rates will be made.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

WATER COMMISSIONERS' OFFICE,
DETROIT, January 2, 1895.

To the Common Council of the City of Detroit:

GENTLEMEN—The Board of Water Commissioners respectfully submits its annual report for the year ending December 31st, 1894. The reports of its General Superintendent, its Civil Engineer and the Heads of Departments are presented herewith, giving in detail the operations of the Board, to which your attention is earnestly invited.

The construction of the new engine, the building of the Hurlbut Memorial Gate, and other general improvements at the Pumping Works grounds, are now completed.

The pumping capacity, with all four engines running, is over one hundred million gallons per day, a condition that will prevent "short supplies," as far as this part of the works is concerned, for some years.

The laying of an additional force main is arranged for and the pipe necessary thereto contracted for, and will be delivered early in the coming year.

The operations of the Board in the past year, especially in the laying of water-pipe, have been conducted largely with a desire to provide work for the unemployed, and much has

I will simply say that the Board determined, after a fair trial, to abandon it, and Mr. Bridge was again placed in charge and the work again proceeded as had been the custom for years.

During the year very much of the work has been conducted with a desire to provide labor for the unemployed; and, in order to reach the greatest number, I have acted under instructions from your honorable body and laid off the men after two weeks' work and taken on new men, largely furnished by the Poor Commission. It was feared that this manner of proceeding would materially increase the expense of laying water-pipe, but by a careful comparison with the cost of former years it was found that there was but little, if any, difference in the cost. The men seemed to make up in eagerness and gratitude for an opportunity to earn a few dollars, what they lacked in experience.

I desire here to make mention of an employé in this department who, by a little ingenuity, saved considerable in the expense of testing pipe in the ditch. The tests usually were made with a portable engine drawn around by horses, and there was substituted therefor, under the suggestion of S. G. Howe, a hand pressure pump, which could be carried around by hand, and, with the addition of certain attachments, was fully as effective in accomplishing desired results as the more cumbersome and expensive steam pump.

The purchasing of horses for doing the hauling of the Board was a wise one, as the gradual and steady increase of this class of work has rendered the time fully ripe for such proceeding. If the teams are kept as busy as the amount of work of the past year would seem to indicate, a saving will be effected in this expense of fully 50 per cent.

The perfecting of the pipe system under the direction of the Chief Engineer has steadily proceeded, until at the present time practically none of the serious deficiences thereof and their consequent annoyances to the Board and myself seem to exist. The daily complaints of the past, the cause for which I struggled to do away with, but which I only partially accomplished, are now things of the past. It is now a most uncommon thing to receive complaints of short supplies, and they are always found, upon investigation, to be due to local troubles rather than to any fault in the system.

Last August, owing to ever-occurring breakages in the valves of the system, caused by their being operated by inexperienced men in the iron pipe department, I organized a small gang of men under John Bridge and placed all the valves under his direct charge, instructing him to proceed at once to a thorough and systematic examination of them. At my request he has made a report of his five months' operations and which I have appended to my report, as it is full of interesting information.

PUMPING WORKS.

The pumping capacity of the Works is now, with all engines running, over 100 million gallons per day. The engine house, instead of being dwarfed by the additions at either end to accommodate the two engines purchased last, seems to have needed these two extensions to perfect it architecturally; and the condition of the grounds has experienced such a marked improvement as to render them one of the most attractive features of our city.

Chief Engineer Gould has not simply contented himself with doing well with what he had to do with, but has exercised in several instances his inventive genius to improve his conditions. The most marked of these actions was his arrangement by which the engines could be converted in five minutes from "double pumps" to single acting. There is a *minimum* as well as a *maximum* capacity to the engines, and it often happens at night that the minimum capacity is too great, in which event it was customary previously to help along in the great "waste" act by opening the waste gate and letting the surplus run back into the well. The arrangement, which is the result of his thought and study, practically unships one of the pumps, and reduces the capacity of the engine to the volume of water required of it, thereby doing away with any necessity and expense of pumping the water up hill simply to see it run down again.

Mr. Scribner, from being a man who knew little or nothing of landscape gardening, has so perfected himself by study and observation as to need but an inspection of his work to establish the fact as to his knowledge of the art.

There is one thing which I have already called to the attention of your honorable body, and that is the removal of the fence around the settling-basin. It is a cheap picket fence and accomplishing no good whatever except to obstruct the view of the river front. If the Board would but consent to its removal, I think the members would be much surprised at the wonderful improvement that would be produced.

OIL AS FUEL.

In the latter part of 1892 we commenced burning oil. In 1891 and a part of 1892, natural gas was used, the contract being, however, to pay to the company what it would cost on the average with coal. Previous to that time coal was used exclusively.

The following table will give a pretty correct idea of the expense under the various fuels in use for the last six years. It will be seen that the rate per million in 1894 was 12 cents higher than 1893, which is owing entirely to the increased head that the engines are pumping against:

YEARS.	GALLONS PUMPED.	PUMPING EXPENSES.			Cost Per Million Gallons.
		Fuel.	Labor.	Total.	
1889.....	12,875,334,453	$34,413 31	$18,999 25	$53,412 56	$4 14
1890.....	12,120,944,532	31,763 40	17,635 99	49,399 39	4 07
1891.....	12,057,261,236	33,826 86	16,911 03	50,737 89	4 20
1892.....	12,476,612,482	31,031 40	18,402 42	49,433 82	3 96
1893.....	13,877,977,208	27,479 93	16,571 59	44,051 52	3 18
1894.....	13,649,779,605	29,283 47	15,874 34	45,157 81	3 30

Average of 1889, 1890 and 1891.....................$4.14 per million.
Per Million in 1893................................ 3.18

Saving by oil, per million.................... ..$ .96

Amount pumped in 1893, 13,877,977,208; multiplied by 96 cents, gives a total saving for the year of $13,322.75.

The following statement shows the entire amount expended at the pumping station, including the original purchase of the land, the improvement thereof, the buildings, machinery, etc.:

ITEMS.	Previously Expended.	1894.	Total.
Land	$35,000 00	....	$35,000 00
Force Mains	621,967 69	$ 2,040 84	624,008 53
Inlet Pipes	90,626 84	185 00	90,811 84
Dock, Basin and Canal	135,309 12	2,101 90	137,411 02
Conduits and Wells	77,670 52	3,791 18	81,461 70
Engine, Boiler and Coal Houses	189,107 12	3,169 84	192,276 96
Stand Pipe and Tower	30,420 72	....	30,420 72
Pump Wells	54,221 56	....	54,221 56
Engines	321,655 56	17,039 18	338,694 74
Boilers	54,248 40	462 61	54,711 01
Engineer's House	8,139 75	....	8,139 75
Sewer	3,666 25	....	3,666 25
Grounds, Fences and Gateway	77,522 44	28,717 91	106,240 35
Inspection	2,977 86	....	2,977 86
Miscellaneous	11,694 80	1,852 87	13,547 67
Totals	$1,714,228 63	$59,361 33	$1,773,589 96

METER DEPARTMENT.

The Superintendent, Mr. Putnam, was placed by the Board in charge of Meters and Inspection in 1890. In 1893 I placed him in charge of the "Service Connections" Department, which includes a surveillance of all the work of plumbers. Last July I placed him in charge of the Repair Department, which afterwards was approved by you. Formerly it was under the Superintendent of Extension, who was obliged so often to be absent on the pipe lines when his services were needed in "repairs," that it became necessary to make a change. All of these duties, thus *loaded* upon him, have been performed excellently, and I have been saved much perplexity and annoyance which were previously my usual diet.

METERS.

The introduction of meters still continues, there having been 722 new ones placed in 1894. The rapidity or volume of the introduction of meters each year has depended, and must still continue to depend, upon the amount of money that the Board could or will be able to spare from its resources. Further, that far from being considered an imposition, as it was the first year, applications *for* them come in now faster than they can be supplied.

The results are of interest. It is a well established fact in regard to water works, that construction and operation expenditures depend largely on the volume of water required to be pumped.

The following table will give some idea of the rapidly increasing *pro rata* consumption while there were practically no meters, and the results that have been obtained since.

HISTORICAL.

The following table is one published last year, with the addition of the results of 1894:

YEARS.	Families Supplied.	WATER PUMPED.		REMARKS.
		Total Quantity.	Per Family.	
1852	......	235,840,275	....	
1853	4,283	303,531,743	70,868	
1854	4,619	376,265,126	81,460	
1855	5,282	542,807,364	102,765	
1856	5,706	692,124,305	121,297	
1857	6,189	697,190,523	112,650	
1858	6,474	718,091,207	110,919	
1859	6,794	782,112,587	115,118	
1860	6,750	870,036,451	125,185	
1861	7,128	895,129,423	125,579	
1862	7,275	994,945,329	136,762	
1863	7,699	1,035,798,043	134,534	
1864	7,993	1,019,390,256	127,410	
1865	8,351	1,040,514,887	125,675	
1866	9,089	1,196,317,922	131,622	
1867	10,242	1,425,535,230	139,186	Average per cent. of increase from 1852 to 1888—12.86.
1868	11,544	1,666,545,125	144,364	
1869	12,774	1,946,810,325	152,400	
1870	13,722	1,866,060,068	136,000	
1871	14,896	2,300,150,605	154,414	
1872	16,035	2,782,292,578	173,513	
1873	17,019	3,198,393,948	187,930	
1874	18,853	3,289,872,635	174,511	
1875	19,606	4,207,454,260	214,600	
1876	20,102	4,065,134,470	200,225	
1877	20,345	4,213,239,790	207,090	
1878	20,603	4,345,743,330	210,927	
1879	21,341	5,129,599,110	240,348	
1880	22,465	5,552,965,310	247,183	Average per cent. of increase from 1879 to 1888, inclusive, 8.5.
1881	23,749	6,543,127,968	279,722	
1882	25,442	6,284,000,742	243,062	
1883	27,415	7,379,327,788	269,170	
1884	29,424	8,510,614,140	289,260	
1885	30,533	9,970,829,580	326,886	
1886	31,946	10,576,571,254	331,070	
1887	34,486	13,168,859,808	381,860	
1888	36,863	**14,380,166,670**	**390,098**	
1889	39,158	12,875,334,453	328,880	*Commenced Metering.*
1890	41,467	12,120,944,532	292,300	
1891	43,933	12,057,261,236	274,470	
1892	46,400	12,276,612,482	264,582	
1893	49,817	13,877,977,208	278,579	
1894	49,912	13,649,779,605	273,476	

It will be seen that the quantity pumped in 1894 is practically the same as that of 1887. The population of the city in

1887 was 184,829. The population in 1894 was 258,834, an increase of 74,000—a large city in itself. No innovation in the conduct of public affairs would be acceptable that does an injustice, nor should any attempt be tolerated in the interest of economy that saves for us, either individually or collectively, at the expense of the other interests. Ninety-five per cent. of those metered pay less than under the assessment plan, and while our receipts are thus reduced, at the same time the expenditures for operation and construction are so largely kept down as to more than double—yes, treble—the expense of the meters. This statement is susceptible of proof, and as a part of such evidence I invite your attention to the following table. The third line and the last two lines are the important ones to consider in this connection. The two years previous to the introduction of meters are taken to show that 1888 was not an unusual year:

COMPARATIVE STATEMENT.

	1887.	1888.	1894.
Daily average consumption in gallons	36,079,068	39,397,716	37,396,656
Daily average consumption per capita	195	204	144
Total annual consumption............	13,168,859,808	14,388,166,670	13,649,779,605
Total consumption through meters..	65,182,000	91,750,000	1,788,378,000
Revenue from unmetered water.....	$316,316.30	$335,140.10	$344,877 69
Revenue from metered water........	$6,518.20	$9,175.00	$73,851.07
Per 1,000 gallons metered water.....	.10	.10	.041
Per 1,000 gallons unmetered water...	.024	.023	.025
Number of families supplied.........	34,486	36,863	49,912
Number of service connections.......	32,938	36,609	47,559
Miles of pipe.........................	322	325	486
Number of meters....................	About 40	48	3,186
Actual operating expenses...........	$82,723.74	$92,402.59	$93,025.22
*Estimated population...............	184,829	194,996	258,834

* Population estimated by multiplying families in city by 5.14.

It is a very simple matter to take the first table and estimate what the amount of water would have been pumped had no restrictions to waste been adopted. The increase from year to year previous to 1889 was 8.5 per cent. Upon the supposition that this increase would have continued, which is reasonable, we would have pumped, in 1894, 31,732,901,624 gallons, or considerably more than double the quantity that was pumped, and an average daily supply of 86,939,453 gallons.

This seems rather wild, yet, when one looks at the column marked "Gallons per Family," and examines critically its sure and steady increase; and when one also sees the quantity pumped by Buffalo last year, which was a daily per capita of (*) 325 gallons, the per capita of which city was in 1888 considerably less than Detroit, which was that year 204 gallons, it becomes less problematical; in fact, as certain as any estimate could possibly be.

For the purpose of demonstrating how this has affected the water-rate payers as individuals, I call your attention to another table that is historical.

YEARS.	No. of Families Supplied.	Rates Received for all Purposes.	Average per Family.	REMARKS.
1876	20,102	$ 205,624 74	$10 23	$10.21 General Average.
1877	20,345	210,288 12	10 33	
1878	20,603	208,193 95	10 10	
1879	21,341	218,110 13	10 22	
1880	22,465	227,452 73	10 12	
1881	23,749	241,884 32	10 18	
1882	25,442	261,725 79	10 28	
1883	27,415	280,049 06	10 21	
1884	29,424	300,467 24	10 21	
1885	30,533	313,205 10	10 25	
1886	31,946	314,952 31	9 86	Family Rates reduced, taking effect July 1st.
1887	34,486	322,834 59	9 36	$9.36 General Average.
1888	36,863	344,315 26	9 34	
1889	39,158	367,925 27	9 39	
1890	41,467	387,877 73	9 35	
1891	43,933	389,079 97	8 85	Hose tax abated, taking effect July 1st. Meter rates reduced to ⅛ of a cent per 100 gallons.
1892	46,400	402,534 98	8 67	
1893	49,817	420,490 83	8 44	
1894	49,912	418,728 76	8 39	

I hope this table will not be passed over with the usual glance that tables ordinarily receive. It proves conclusively several important facts. The first *ten* years' statements prove that, though rates are assessed upon and received from all classes of consumers in a city, if the schedule of rates remain the same, the rates divided by the number of families supplied will produce the same quotient; that is, the average per family will remain the same. The average for ten years preceding 1886 was $10.21 per family.

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* See Water and Gas Review, January, 1895.

Any reduction of rates and its effect on the income of the Board can be almost exactly measured by multiplying the number of families of the year by the average per family previous to the reduction. In 1886 the charge for household purposes for a private family was reduced from a sliding scale of $5, $6, $7, etc., according to the number in the family, to the nominal sum of $5.00. This took effect July 1, 1886. The *average* of the four years thereafter was $9.36, or 85 cents less. Multiplying the number of families of any year by 85 cents will give the reduction of the income consequent. Families of 1890, 41,467; multiplying by 85 cents gives a reduction of income, $35,246.95.

In 1891 the tax on hose for *lawn and street sprinkling* was abated, taking effect July 1st. At the same time the meter rates were reduced from 10 cents per 1,000 gallons to 6⅔ cents, then to 5 cents, and finally, October 1st of that year, to 3⅛ cents, where it now stands. The reductions of 1891, 1892, 1893 and 1894 are not due entirely to these changes of rates, as meters were being constantly placed, almost all of said consumers paying less than under the *assessed* rates. This can, however, be very closely calculated, as the hose reduction was, by a careful examination of the books, known at the time to be about $20,000 per annum. We make, then, the reductions in income of 1894, as compared to the schedule of rates of 1885, as follows:

49,912×85 cents, gives reduction of rates for families	$42,425.00
Abatement of hose	20,000.00
Leaving for reductions of meter rates, etc	28,448.00
A total of	$90,873.00

This amount was saved to water-rate payers in 1894, and, proportionately, the same amount each year, and still the Board continues to pay from its resources all expenditures for operation and construction, and a certain portion of its bonded indebtedness.

The last bonds issued by the Board was in 1881, since when it has redeemed from its resources $519,000 of bonds. It has, however, received from the general tax levy in that time $963,331.21, of which $650,000 has gone to pay the interest upon the bond issue of 1873, leaving $313,331 to assist in the payment of the $519,000. In this time, therefore, $205,668 of bonds have been paid from the ordinary resources of the Board, as well as the interest upon all bonded indebtedness outside the issue of 1873.

It is sometimes claimed that where all consumers are not metered it is prejudicial to those using them. This might be the case where the relationship between the assessment and meter rates are not carefully watched and adjusted, as they are in Detroit, so as to make them correspond. In a report from the Water Works of a certain city, I saw that one-fifth the water that was pumped passed through meters, and in another place in same report I saw that the meter rates received was one-half the total receipts. In other words, one-fifth of the consumers paid one-half the income. This is a common feature in the rates of different cities.

By the last table it will be seen that the receipts for metered water was $4\frac{1}{10}$ cents per thousand gallons, and that the receipts for unmetered water was $2\frac{5}{10}$ cents. It must be remembered, however, that the "unmetered" water includes all water that is lost by leaks in supply and distribution pipes, and all water consumed in public parks, by the Fire Department for ordinary consumption and also for fires. This, by careful estimates, is placed at fully 25 per cent. of the whole quantity. Deducting this quantity and dividing rates received by the remainder, we have for each thousand gallons nearly $3\frac{9}{10}$ cents, or one-fifth of a cent less than for metered water. This one-fifth of a cent per thousand gallons is calculated to be sufficient to pay for use and repairs of meters.

If there is anything that works prejudicial to one consumer as against another, it certainly is the estimating or "guess" plan. In 1889, the placing of meters upon ten prominently large consumers developed the fact that they had been paying all the way from *one cent* per 1,000 gallons up to *twenty* cents. Two different manufacturers, engaged in the same business, one had been paying at the rate of *one cent* and the other at the rate of *six and one-fourth cents.*

Every meter that is put on, establishing the true quantity of water consumed, reduces the discrimination that has always existed under the assessment plan.

SCHEDULE OF RATES.

I have considered it my duty from time to time to recommend to your honorable body, which recommendations have always been adopted, certain reductions in the "meter" and "assessed" rates. In 1890 the meter rates were reduced to 3½ cents per 1,000 gallons, because it was estimated that the cost of pumping, upon the basis of the operating expenses and the interest on the plant, was about 3 cents per thousand. The reductions following, such as the abatement of the hose tax in 1891 and the subsequent change of rates last July, were made simply to maintain a proper relationship between the "meter" and "assessed" rates. The use of the term "free hose" is really a misnomer, as it is considered, or was when the reduction was made, that there was a sufficiently large assessment imposed for household purposes to pay for the water used in sprinkling lawns and streets. This reduction or abatement of charge for lawn and street sprinkling originated from a desire of the Board to reduce the "assessed" rates about $25,000 per annum. It found that the income from that source was larger in proportion than that from the supply of water through meters; and it also found that the above reduction in its income could be made to the benefit of the water-takers without injury to the works.

Previous to the making of this report, I had written to all of the cities having a population of over 80,000, and requested their meter rates. From those who answered, I have prepared the following table, that will give valuable information and will show that Detroit practically has the lowest meter rate in the world, with the exception of Washington, which is 3 cents per thousand. Washington water is supplied by gravity, and the construction expenditures to a large extent provided for by appropriations by Congress. Buffalo has but few meters; none where the consumption requires an annual payment less than $50. It has also what may properly be considered as an aristocracy of prices, as indicated in the table:

CITIES.	Annual Payment. Consumption 150,000 Gals. Monthly.	Annual Payment. Consumption 1,500,000 Gals. Monthly.	Annual Payment. Consumption 3,500,000 Gals. Monthly.
Detroit	$ 69 00	$ 609 00	$ 1,409 00
Chicago	180 00	1.476 00	3,396 00
Milwaukee	282 00	1,075 00	1,915 00
Washington	54 00	540 00	1,260 00
Baltimore	108 00	1,080 00	2,520 00
Kansas City	325 00	....	....
Cleveland	96 00	960 00	2,240 00
Toledo	165 60	1,243 80	2,482 80
Syracuse	270 00	1,080 00	2,520 00
Rochester	180 00	1,800 00	4,200 00
Providence	360 00	2,700 00	6,300 00
Boston	103 00	2,880 00	6,072 00
Cincinnati	162 00	1,620 00	3,780 00
St. Louis	315 00	2,250 00	4,375 00
Alleghany	180 00	1,800 00	4,200 00
Brooklyn	180 00	1,800 00	4,200 00
Indianapolis	204 00	1,500 00	2,940 00
New Orleans	108 00	1,620 00	3,096 00
St. Paul	180 00	1,800 00	4,200 00
Buffalo. Factories	50 00	360 00	840 00
Commercial	72 00	720 00	1,680 00
Elevators	108 00	1,080 00	2,520 00

FINANCIAL REPORT

BY THE

SUPERINTENDENT AND SECRETARY

For the Year 1894.

RECEIPTS.

Water Rates Account—	
Rates paid	$418,728 76
Percentage Account—	
From delinquents	7,475 67
Penalties for shutting off	508 50
Plumbers' License Account—	
Paid for licenses	608 15
Service Cocks Account—	
Labor and material	5,717 19
City of Detroit Account—	
Tax levy	73,901 87
Repairing Leaks Account—	
Labor	116 85
Engineering Account—	
Material	38
Iron Pipe Account—	
Labor and materials	24,148 53
Bonus paid for extensions	465 63
Hurlbut Fund Account—	
Payments from trustees	5,100 00
Real Estate Account—	
Rentals	2,475 00
Meters Account—	
Sale of Material	795 30
Interest Account—	
On deposits general account	2,016 51
" " sinking fund	450 37
Loan Account—	
Loan	50,000 00

Horse and Wagon Account—		
Sale of Horse		$35	00
Pumping Water Account—		
For water by farmers	7	90
Total receipts	$592,551	61

EXPENDITURES.

FOR CONSTRUCTION.

Iron Pipe Account—

Superintendent and clerks	$7,468	33
Labor	106,521	37
Iron pipe	71,263	31
Special castings	11,677	62
Tools, and repairing of	1,485	32
Hauling	3,103	81
Lumber	1,286	08
Coal	335	16
Oil	81	48
Packing	632	70
Lead	9,198	51
Iron cylinders	111	00
Plugs	91	65
Testing covers	63	00
Rubber disc and engine	164	84
Repairs, and materials for	263	27
Diaphragms	91	80
Repaving	13,594	71
Street car and toll tickets	311	02
Livery	72	00
Wagon and harness supplies and repairs	1,011	62
Feed	1,008	86
Shavings	25	00
Farrier	121	75
Materials	720	81
Stationery, books, etc	178	87
Car rental	1	00
Gate boxes	834	52
Clothes spoiled at riot	52	56
Guages	21	49
Machine	20	80
Horse board	90	00
Brick	1,575	19
Sand	186	01

Park and boulevard	$291 32	
Medical and hospital attendance	226 00	
Freight and express	2,504 08	
Gate wells	1,584 32	
Tapping machine	1,150 00	
Stove	16 80	
Valves	9,525 75	
Pipe jointers	481 41	
Revolvers	345 46	
Fittings	161 97	
		$249,952 57
PUMPING WORKS ACCOUNT—		
Labor	2,310 75	
Cut stone work	372 30	
Carving contract	600 00	
Mason work	371 93	
Iron Work	1,659 83	
Carpenter work	246 46	
Hauling pipe	435 89	
Painting	187 90	
Fixtures	76 30	
Horse and cart	409 34	
Pump cage	186 40	
Work on engine house	48 84	
Meter	321 00	
Repairing conduit	2,044 09	
Fittings, valves, etc	1,444 75	
Medical attendance	6 50	
Work on inlet pipe	185 00	
Repairs to new well	56 04	
Brick	245 75	
Architect	284 43	
Cement	158 50	
Material—tools, lumber, etc	259 89	
Engine contract	17,039 18	
Rebuilding arch	198 15	
New attachments	140 76	
Beams	51 54	
		$29,841 52
OIL PLANT ACCOUNT—		
Reid's burners	160 00	
		$160 00

METER ACCOUNT—

Superintendent and labor	$9,178 45	
Meters	8,795 09	
Freight and express	51 03	
Specials and fittings	1,056 84	
Horse board and shoeing	262 25	
Medical attendance (horse)	2 00	
Repairs to harness and vehicles	51 92	
Bicycles	50 00	
Blanket	3 00	
Street car tickets	20 70	
Hauling	137 15	
Material—brass, solder, lumber, etc.	477 10	
Tools, and repairing of	12 95	
Printing, stationery and postage	54 90	
Meter wells	251 51	
		$20,404 89

REAL ESTATE ACCOUNT—

Insurance	$299 99	
Repairing boiler	1 96	
Plumbing	30 53	
Repairs to buildings	332 31	
Material	15 10	
Building addition to barn	1,028 27	
Labor	1,599 84	
		$3,308 00

ENGINEERING ACCOUNT—

Civil engineer and assistants	$5,894 92	
Materials, instruments, etc.	779 52	
		$6,674 44

HORSE AND WAGON ACCOUNT—

Horses	$1,495 00	
Harness	223 50	
Vehicles and parts thereof	1,350 00	
		$3,068 50

OFFICE FURNITURE AND FIXTURE ACCOUNT—

Furniture and Fixtures	$281 84	
		$281 84

Aggregate		$313,191 76

OPERATION AND MAINTENANCE.

OFFICE ACCOUNT—		
Secretary, assessors and clerks	$18,621 88	
Watchman and janitors	1,292 25	
Printing and binding	1,149 54	
Advertisements and subscriptions	241 30	
Supplies—soap, matches, etc	42 44	
" stationery	180 53	
Furniture and fixtures	23 00	
Extra services	673 62	
Expert examiners	1,451 20	
Fuel	414 73	
Light	338 34	
Postage and telegrams	157 80	
Germicide	36 00	
Ice	16 00	
Street car tickets	35 00	
Horse board	219 25	
Farrier	38 50	
Harness and buggy repairs	17 20	
" hardware	3 00	
House and furniture repairs	20 96	
License	1 00	
Telephone rent	639 99	
Premium on guaranty bonds	430 00	
Overpaid water rates	682 50	
Refund (Greuner)	7 10	
Entertaining Boston officials	8 00	
Money bag	11 00	
		$26,752 13
PUMPING WATER ACCOUNT—		
Engineers and firemen	$15,874 24	
Consulting engineer	1,110 00	
Fuel oil	30,232 42	
Coal	87 90	
Printing, telegraphing, stationery	9 14	
Supplies—rags, waste, soap, etc	315 93	
" valves, gaskets, packing, etc	346 49	
Boiler and machine repairs	218 58	
Lubricants	412 43	
Insurance	400 00	
Car rental	4 00	
Saws	30	
Medical attendance	3 50	
Repairs to wagon and harness	6 65	
Feed, shoeing, etc	33 83	

Street car tickets	$11 50	
Electric light	6 59	$49,073 50
WATER RATES ACCOUNT—		
Overcharge returned	$42 73	$42 73
PERCENTAGE ACCOUNT—		
Labor	$1,842 00	$1,842 00
REPAIRING LEAKS ACCOUNT—		
Labor	$10,137 81	
Wagon and harness repairs	54 80	
Feed and stabling	270 45	
Farrier	97 50	
Street car and toll tickets	85 00	
Repairing tools	8 70	
Tools and materials	184 32	
Repairing pavement	146 57	
Meals	4 60	$10,989 75
SERVICE CONNECTIONS ACCOUNT—		
Labor	$6,542 21	
Cart and harness repairs	69 28	
Blankets, etc	18 40	
Cocks and valves	2,211 66	
Farrier	55 75	
Material	126 39	
Special taps	43 50	
Horse board	25 00	
Toll and express	1 60	$9,093 79
INSPECTION ACCOUNT—		
Labor and material	$3,391 02	$3,391 02
PLUMBERS' LICENSE ACCOUNT—		
Licenses returned	41 00	$41 00
METER REPAIRS AND EXPENSES ACCOUNT—		
Fittings, etc	$126 22	$126 22
Aggregate		$101,352 14
BONDED INDEBTEDNESS ACCOUNT—		
Bonds paid	$25,000 00	$25,000 00

LOAN ACCOUNT—

Loan paid	$50,000 00	
		$50,000 00

INTEREST ACCOUNT—

Interest paid	$65,487 65	
		$65,487 65

PARK AND BOULEVARD COMMISSION—

Laying pipe Belle Isle Crossing	$797 25	
		$797 25

HURLBUT FUND ACCOUNT—

Superintendent, librarian and labor	$7,447 52	
Plants, trees, flowers, fertilizers, etc	287 30	
Tools and materials	261 47	
Horse feed, etc	72 47	
Memorial gateway (part)	19,729 58	
Lumber	10 99	
Excavating canal	2,101 90	
Towing lighter	72 00	
Hose, etc	28 93	
Toll	2 15	
Cement	5 50	
		$30,019 81

RECAPITULATION.

Construction expenditures	$313,191 76
Operation and maintenance expenditures	101,352 14
Bonded indebtedness	25,000 00
Loan account	50,000 00
Interest	65,487 65
Park and Boulevard Commission	797 25
Hurlbut Fund	30,019 81
Aggregate	$585,848 61

ACTUAL OPERATION EXPENSES.

The actual operating expenses are the foregoing expenditures for operation, less the credits by cash received for said expenditures, and are as follows:

Office account		$26,752 13
Pumping water		49,073 50
Water rates	$42 73	
Overpaid amounts returned	....	
		....
Percentage	$1,842 00	
Receipts, percentages and fines	7,984 17	
		....
Repairing leaks	$10,989 75	
Receipts for services	116 85	
		10,872 90
Service connections	$9,093 79	
Receipts—services and material	6,325 34	
		2,768 45
Inspection		3,391 02
Plumbers' licenses—payments returned		41 00
Meter repairs		126 22
Total		$93,025 22

RECEIPTS OF WATER RATES BY DISTRICTS.

YEAR.	1st District Wards 9 and 15.	2d District, Wards 11 and 13.	3d District, Wards 1 and 7.	4th District, Wards 3 and 5.	5th District, Wards 2 and 6.	6th District, Wards 10 and 14.	7th District, Wards 4 and 12.	8th District, Wards 8 and 16.	Meters.	Aggregate.
1888–9	....	....	....	....	....	$3 75	....	....	....	$3 75
1889–90	....	....	....	$1 25	....	1 25	....	....	....	2 50
1890–1	....	....	....	5 00	....	5 00	....	....	....	10 00
1891–2	$1 88	$2 50	$55 50	2 50	....	10 00	....	....	....	72 38
1892–3	14 75	24 25	30 50	27 50	$336 75	77 75	$26 75	$60 75	....	599 00
1893–4	22,493 66	18,452 13	24,122 26	21,841 18	26,021 29	19,552 54	23,362 10	19,280 85	$33,649 50	208,775 51
1894–5	23,487 65	17,749 06	22,365 78	20,294 22	24,893 35	18,993 21	22,317 32	18,963 46	40,201 57	209,265 62
Total..	$45,997 94	$36,227 94	$46,574 04	$42,171 65	$51,251 39	$38,643 50	$45,706 17	$38,305 06	$73,851 07	$418,728 76

CERTIFICATE OF EXPERT ACCOUNTANT.

DETROIT, January 31st, 1895.

To the Honorable Board of Water Commissioners, City of Detroit:

GENTLEMEN—I have made an examination of the books and vouchers of the Detroit Water Works for the year ending December 31, 1894, and hereby certify that the following statement is correct:

CASH STATEMENT.

1894.			
Jan. 1,	Cash on hand	$4,748 48	
	Commercial National Bank Balance, General Fund	33,450 22	
	Commercial National Bank Balance, Secretary's Fund	500 00	
Dec 31,	Receipts 1894	592,551 61	
			$631,250 31
1895.			
Jan. 1,	Cash on hand	$5,978 94	
	Commercial National Bank Balance, General Fund	38,922 76	
	Commercial National Bank Balance, Secretary's Fund	500 00	
	Disbursements 1894	585,848 61	
			$631,250 31

Respectfully submitted,

J. A. M. MORETON,
Auditor.

ASSESSMENT 1894-95.

Dist.	WARDS.	Families.			Vacant Tenements.	Increase Supplied.	Assessment.		
		Supplied.	Not Supplied.	Whole Number.			1894-95.	Increase+ Decrease—	Transf'rd to Meter Rolls.
1	Ninth.......	5,137	13	5,150	203	— 53	$27,493	—$2,290	$374
	Fifteenth...	2,700	81	2,781	118	262	16,977	1,475	293
	Totals ...	7,837	94	7,931	321	209	44,470	— 815	667
2	Eleventh ...	3,481	21	3,502	160	35	20,846	— 904	256
	Thirteenth..	2,449	16	2,465	100	94	14,647	— 152	294
	Totals ...	5,930	37	5,967	260	129	35,493	— 1,056	550
3	First........	2,493	8	2,501	197	11	25,289	— 3,143	795
	Seventh	3,235	27	3,262	196	— 60	18,500	— 2,291	615
	Totals....	5,728	35	5,763	393	— 49	43,789	— 5,434	1,410
4	Third.......	3,207	10	3,217	120	— 64	19,457	— 2,238	847
	Fifth........	3,670	5	3,675	124	49	21,323	— 1,459	446
	Totals ...	6,877	15	6,892	244	— 15	40,780	— 3,697	1,293
5	Second	2,010	12	2,022	147	0	24,509	— 2,699	1,211
	Sixth........	3,432	6	3,438	257	40	24,354	— 1,020	471
	Totals ...	5,442	18	5,460	404	40	48,863	— 3,719	1,682
6	Tenth.......	4,036	8	4,044	163	— 12	24,587	— 841	504
	Fourteenth.	2,259	35	2,294	132	70	13,352	155	142
	Totals ...	6,295	43	6,338	295	58	37,939	— 686	646
7	Fourth.. ...	3,031	4	3,035	230	— 221	25,484	— 3,198	1,047
	Twelfth	3,069	5	3,074	215	— 75	18,052	— 772	177
	Totals ...	6,100	9	6,109	445	— 296	43,536	— 3,970	1,224
8	Eighth......	3,158	9	3,167	231	— 3	21,936	— 1,120	332
	Sixteenth...	2,545	185	2,730	141	22	14,718	— 449	24
	Totals ...	5,703	194	5,897	372	19	36,654	— 1,569	356
	Aggregate	49,912	445	50,357	2,734	95	$331,524	—20,946	$7,828

It will be seen by the foregoing table that there is a decrease of $20,946 from the assessment of 1893.

This is caused, first, by assessments amounting to $7,828 being taken from the rolls because of being metered.

The principal cause, however, was the reduction in the rates made by the Board April 11th, to take effect July 1st, which were as follows:

Additional closets to first, reduced from $2.00 to $1.00.

Charge on stationary wash tubs of $2.00, for private families, abated entirely.

Additional families over first family in same house and supplied through one faucet, to be reduced from $5.00 to $3.00.

By a careful inspection of the rolls, this reduction was estimated to be

On closets	$4,200 00
On wash tubs	5,226 00
On families	10,812 00
Total	$20,238 00

Upon the basis, therefore, of what was left on which to make assessments, there was really an increase of $7,120.

The increase of 95 families shows that the city did not exactly stand still under the effects of hard times.

WATER WORKS BONDS.

The following table shows the whole history of the bonded indebtedness of the Board, in which will be seen that the total amount of bonds issued is $1,850,000, of which $717,000 have already been redeemed, leaving outstanding $1,133,000, upon which there is an annual interest of $69,070.

No. of Issue.	Act of	Issued.	Payable.	Amount.	Rate of Interest.	Redeemed.	Outstanding.
1st	1853	Aug. 1, 1853	Aug. 1, 1883	$100,000	7cts.	$100,000	....
"	"	" "	Aug. 1, 1878	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1873	50,000	7 "	50,000	... .
2nd	1855	Aug. 1, 1855	Aug. 1, 1890	100,000	7 "	100,000	....
"	"	June 12, 1855	Aug. 1, 1885	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1880	50,000	7 "	50,000	....
3rd	1857	Aug. 1, 1858	Aug. 1, 1898	150,000	7 "	100,000	$50,000
"	"	Aug. 1, 1867	Aug. 1, 1887	100,000	7 "	100,000	....
4th	1869	Feb. 1, 1870	Feb. 1, 1900	100,000	7 "	....	100,000
5th	"	Aug. 1, 1872	Aug. 1, 1902	50,000	7 "	....	50,000
6th	"	Aug. 1, 1873	Aug. 1, 1903	50,000	7 "	....	50,000
"	1873	Feb. 1, 1874	Feb. 1, 1904	50,000	7 "	9,000	41,000
7th	1869	Aug. 1, 1874	Aug. 1, 1904	50,000	7 "	6,000	44,000
"	1873	" "	" "	200,000	7 "	....	200,000
"	"	June 1, 1875	June 1, 1905	150,000	7 "	1,000	149,000
"	"	June 1, 1876	June 1, 1906	200,000	6 "	1,000	199,000
"	"	Sept. 1, 1880	Sept. 1, 1899	100,000	4 "	....	100,000
"	"	April 1, 1881	April 1, 1897	100,000	4 "	....	100,000
"	"	Dec. 1, 1881	Dec. 1, 1896	50,000	4 "	....	50,000
				$1,850,000		$717,000	$1,133,000

The $50,000 of bonds "outstanding" of the issue of Aug. 1st, 1858, are collateral for loan due Feb. 7th, 1895, at which time it is the intention of the Board to retire them.

One hundred thousand dollars will be issued early in the year in accordance with a resolution of your honorable body Nov. 6th, 1894.

This issue is made necessary by the laying of a new force main from the pumping works, estimated to cost $160,000.

In closing, I desire to commend the subordinate employes of the works, and particularly those engaged in the receiving of money, generally for their kind and considerate manner to water rate payers, and also for the willingness with which they have performed their arduous duties.

A position in the water office is usually regarded as "a soft snap," but if any one will spend a few hours, or days, in our "bee hive" and see the amount of work these officials perform, and the hours each day that they devote to it, the contrary fact will become very apparent.

All of which is respectfully submitted.

L. N. CASE,
General Superintendent and Secretary.

REPORT OF SUPERINTENDENT OF GATES.

DETROIT, January 2, 1895.

L. N. Case, Gen'l Superintendent and Secretary Detroit Water Works:

DEAR SIR—In compliance with your request, I respectfully present for your consideration my report of Gates examined and repaired, together with a statement of gate wells built and well covers adjusted to conform to a new pavement or grade, also repairs made to sewers that were necessarily cut into by the operations of pipe laying.

WELLS BUILT IN 1894.

106 by contractor Goodenow, $1,584.32; covers, $597.84	$2,182 16
445 by Detroit Water Works, (day work)	7,345 78
551 wells. Total	$9,527 94
172 well covers adjusted and 19 sewers repaired	$ 210 50

The well covers heretofore used are not adjustable to the grade of the street, only by adding to or removing the brick work of well, which is costly and annoying, as it is difficult to get to do it as promptly as we would wish. I therefore suggest that an adjustable well cover be used which would obviate the difficulty and expense, if one is found practicable. I have already designed a model of a cover which will, I think, answer the requirements, and which I have submitted to you for examination.

In this connection, however, I would respectfully recommend that in future wells be built only over gates that are in paved streets and out of order, as in unpaved streets the grade is not well established, or a deep ditch may be on each side, in which case an iron box will answer every requirement.

While on the subject of gate wells, I would say that the examination of the large gates has disclosed the fact that many of the timbers covering the wells built over them are very much decayed and consequently unsafe. During the latter part of 1894, I removed the timbers and built brick arches over five of the worst ones, and as soon as the season opens for work in the spring, I would suggest that the remainder be put in good and safe condition.

About the middle of last August, I was ordered by you to examine all the gates in the system and to repair such as were out of order. As the operating of gates is one of the most serious and important duties to be performed in a water works, it was with considerable trepidation on my part that I undertook its performance. I sent out two gangs, one east and one west from Woodward avenue, both of them to work north from the river to the gates south of the upper 42-in. and 30-in. in Canfield, Calumet and Buchanan, and from Vinewood to St. Aubin avenues.

This somewhat extensive district apparently has lately received but little attention, so far as gates are concerned, as our examination disclosed a large number either broken, shut, or not conforming to the established uniformity as to size of head of spindle, etc. I therefore proceeded to repair them as fast as possible, as this district is densely built up, and in which there are a large number of wood-working establishments and lumber yards; but severe cold weather in November compelled a cessation of this work, as the ground was soon frozen to a depth of 18 or 20 inches, but we are at the present time repairing gates that are in wells, and cleaning the snow and ice from over the main gates.

Below please find a statement of gates that have been examined, repaired, etc., up to Dec. 31st.

Whole number examined and tested		2,689
In good order	2,138	
In good order, but shut	123	
Broken and shut	171	
In bad order	257	2,689

Opened	123	
Repaired and opened	171	
Repaired	169	
To be repaired	88	
In good order	2,138	2,689

Discontinued 3 gates and set 2 new ones.

These have been reported to the Extension and Engineering Departments.

Our work, examining gates, discloses a large percentage of decayed wood boxes, and some iron ones that are filled with sticks, stones, etc., or not up to grade.

To be able to work a gate properly, it is imperative the box should be clear, and to clean them out the box must be dug up. What has been done in this will be found below.

Decayed wood boxes		107
Iron boxes filled up		19
Wood boxes replaced with iron	36	
Iron boxes cleaned out	19	
Iron boxes set to grade	53	
Cost—labor, gates and boxes	$1,156 24	

All of which is respectfully submitted,

JOHN BRIDGE.

REPORT OF THE CIVIL ENGINEER.

January 26, 1895.

To the Honorable Board of Water Commissioners of the City of Detroit:

GENTLEMEN—In conformity with the regulations governing this Department, the Civil Engineer presents for your consideration the following annual report:

The work of the year just past has been so intimately connected with that of 1893 that the two must be, in a measure, considered together. While it is the province of the various heads of departments to consider parts of our system, the Civil Engineer has to deal with it in its entirety.

Scientifically, our system is regarded as a machine, of which the intake conduits, the boilers, the engines, the distribution system, the fire hydrants, even the plumbing and fixtures in the buildings of our consumers are but parts of a complete whole. The purpose of every machine is to do work or to transform energy. Our machine changes the latent powers of the fuel to the active forces of the jets of water that flow from our penstocks. In every machine there are certain losses of operation which render it impossible to get back as much energy as is put in, and it is the effort of the designer to reduce these losses to as small an amount as possible. The quotient obtained in dividing the work extracted by that put into a machine is called its *efficiency*.

The theoretically perfect machine would be so adjusted that every part should work with its maximum efficiency at the same time. In practice, it often happens that this is impossible, and in water works construction especially we frequently find that when one part of the machine is affording maximum economy, another part may be working at its worst. For every machine, simple or complex, there will be certain conditions of operation which will produce maximum efficiency, and any variation from these conditions will result in diminished economy. The work of machines is usually measured by the foot-pound, which is the amount of energy expended in raising one pound of matter one foot high against the force of gravity. The losses in a water works system may be classed under two heads: losses due to overcoming the elevations of the territory supplied, and losses due to frictional resistances in the pipes. The former will change only with the quantity of water elevated, while the latter will also be affected by the velocity of flow. In our system, during the past year, less than one-half of the work done by the engines was delivered to the consumers in a form to be utilized. Of the quantity lost, which ranged from about 45 per cent. to 65 per cent. of the whole, a nearly constant portion, averaging about 36 per cent. of the whole, was used in overcoming the elevations of the system, while the remainder, averaging 16 per cent. of the whole, was consumed by friction. As we cannot change the location of the city, the work expended in the former case cannot be reduced, except by lessening the consumption of water, but the losses due to the latter cause may be decreased within certain limits, by proper modifications and manipulations of the distribution system, though they can never be wholly eliminated.

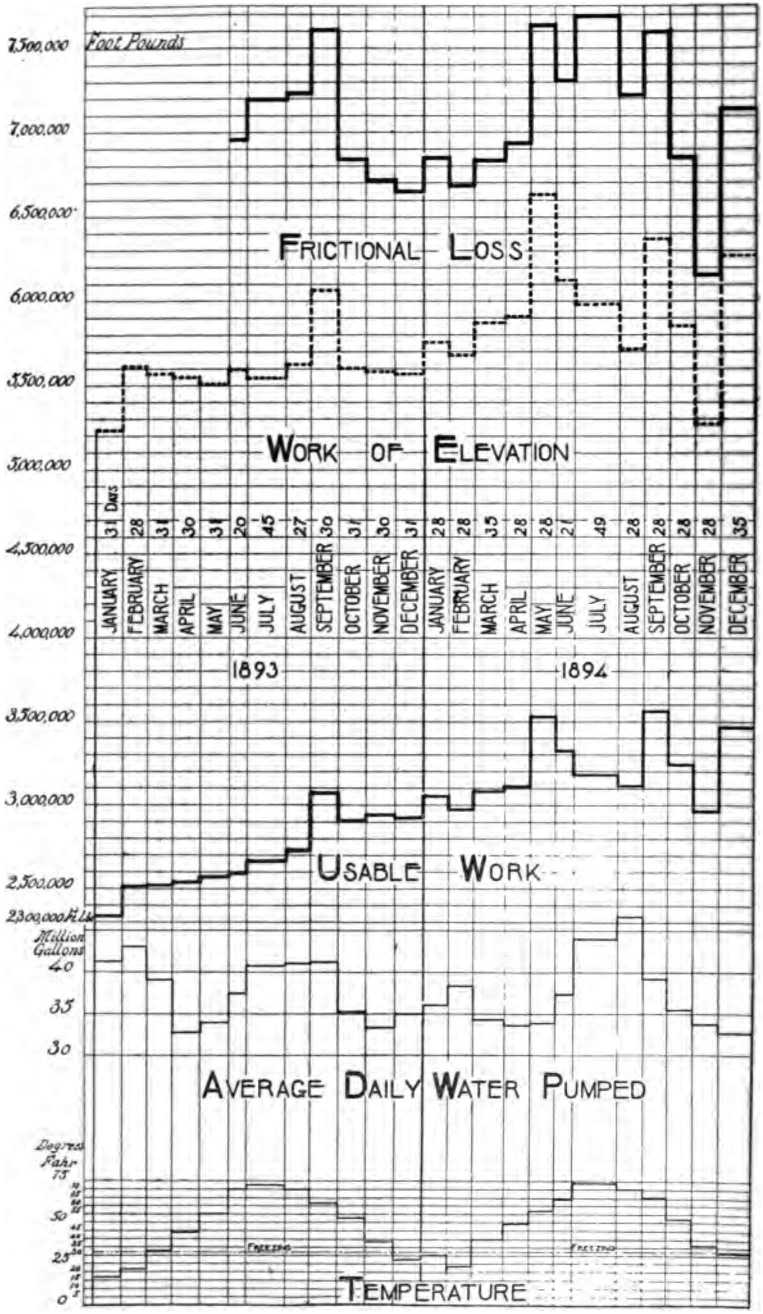
In order to thoroughly understand the investigations embodied in this report, it is necessary that the sources of the information and the method of utilizing it be explained. To begin with, the work that our engines have to do is to take the water from the level of its surface in the pump wells and elevate the necessary quantity to such a height, or give to it such a pressure, as will enable it to flow to the points at which it is consumed, and have remaining a sufficient head or pressure for the purposes of its use. At the engines an hourly record is kept of the quantity of water pumped—measured by piston displacement—and of the pressure pumped against. When these quantities are multiplied together, the product measures the work done by the engines. It is therefore seen that increasing either the pressure pumped against or the quantity pumped increases the work, and that as much work is required to pump one million gallons of water against fifty pounds pressure as to pump two million gallons against twenty-five pounds pressure. There is also kept a record of the quantity of fuel consumed, and by dividing the work done as deduced above by the number of gallons of oil burned, the work per gallon of oil is obtained. From this it may be determined which engine or which boilers or what method of burning gives the best results.

For the purpose of obtaining the amount of work that our system is delivering to the consumers, as well as to have notice of any localities deficient in pressure, there have been established at various points about our system, mainly in fire-engine houses, pressure gauges connected to our mains, from which readings are recorded every hour. Each gauge is then taken as representing a district, whose area is determined by the topography and the arrangement of our mains. If now the pressure on each gauge be multiplied by the area of its district, and the sum of the products so obtained be divided by the sum of the areas, the result will be an average pressure for the city. The locations of the several gauges are shown by the double circles on the map opposite page 52. In these investigations for want of a more accurate basis of computation it has been assumed that the consumption of water is uniform throughout the area of our city. Owing to the situation of our pumping plant with reference to the center of the system, from which it appears that about the same quantity of water will be consumed between the works and the place of maximum consumption, as will be consumed beyond the latter point, and because the distance from the engines to the center of the district of maximum consumption is very nearly a mean between the distances to the centers of the districts east and west of it, the above assumption may be shown to be reasonably accurate as regards total or average results. On this assumption, if now the quantity of water pumped be multiplied by the average pressure above obtained, the product will be the Usable Work of the system, or that which may be utilized for the purposes of the consumer. Further, if the elevation of each gauge above the river be multiplied by the area of its district and the sum of these products be divided by the sum of the areas, the quotient will be the mean or average elevation of the system; and when the quantity of water pumped is multiplied by this mean elevation, the product is the Work of Elevation. If, from the total work of the engines, the sum of the Usable Work and the Work of Elevation be subtracted, the remainder will be the work expended in overcoming frictional resistances. In making the computations for the data herein, the work of the engines has been figured for two periods each day, and these results together with the gauge readings have been averaged by weeks.

Turning now to Plate I, page 42, the area included between the top irregular line and the bottom of the plate represents the *work of the engines* for the periods indicated near the middle of the plate. The area between the same line and the broken line below it, represents the *work of overcoming friction.* The area between this broken line and the full jagged line next below, represents the *work of elevation.* The area between this last jagged line and the bottom of the plate, represents the *usable work,* all upon the basis of the work of one gallon of oil. The lowest irregular line of the plate shows the mean temperature, and the irregular line next above gives the average number of gallons of water consumed daily. Considering now the first mentioned line, the ordinates to it from the base of the diagram give the average daily work of one gallon of oil at the engines for the various periods. This line, it will be noted, begins June 1, 1893; previous to that time no continuous record of the head pumped against at the engines was kept, hence it is impossible to carry the line back of that point. The first manipulations leading to the readjustment of the distribution under the direction of your Engineer took place in March, 1893, and as described in the Report of last year resulted in a slight improvement in the condition of the system. No further changes were made until June 20th following, so that the record of the first twenty days of June may be taken as a fair representative of the period preceding. It is seen at once by the rise in the top line that after the latter readjustment, the work performed by each gallon of oil was materially increased. This increase continued through August, and in September there is a still further increase, which is to be accounted for by the fact that two engines were run at full capacity during the night for most of the month, and the excess water so pumped was wasted into the well. Experiments since that time indicate that the probable amount of water so wasted was between one and two million gallons each night. In October, owing to the decreasing consumption and the colder weather, which latter required the use of oil for heating, the work began to decrease and continued so to do for the same reasons, until the close of the year. About the first of January, 1894, the pressure was increased on the down-town system, and this, together with a slight rise of temperature, as shown by the bottom line of the diagram, accounts in a measure for the increased work of the oil in that month. In February, extremely cold weather again lowered the line, which the warmer temperature of March raised to and above the former point. The same cause accounts for the gain in April, and in May a slight increase in pressure and the running of the new engine combined to produce a marked favorable effect. In June, although the quantity of water pumped considerably increased, the fact that Engine No. 4, the new engine, did not run, and other undetermined causes, reduced the work of the oil. July was the banner month at the pumping station. The quantity of water consumed required the running of the engines much of the time at their most economical rates, and the same conditions seem to have held in August, so that the drop in the line for the latter month appears to be one of those occurrences so frequently met with in experimental work which seem to baffle explanation. A part of the difference may be explained by the fact that Engine No. 4 ran in July a portion of the time and not at all in August, but beyond this no reason is apparent. In September, Engine No. 4. again ran and a more even demand for

Plate 1.

WORK OF ONE GALLON OF OIL AT ENGINES



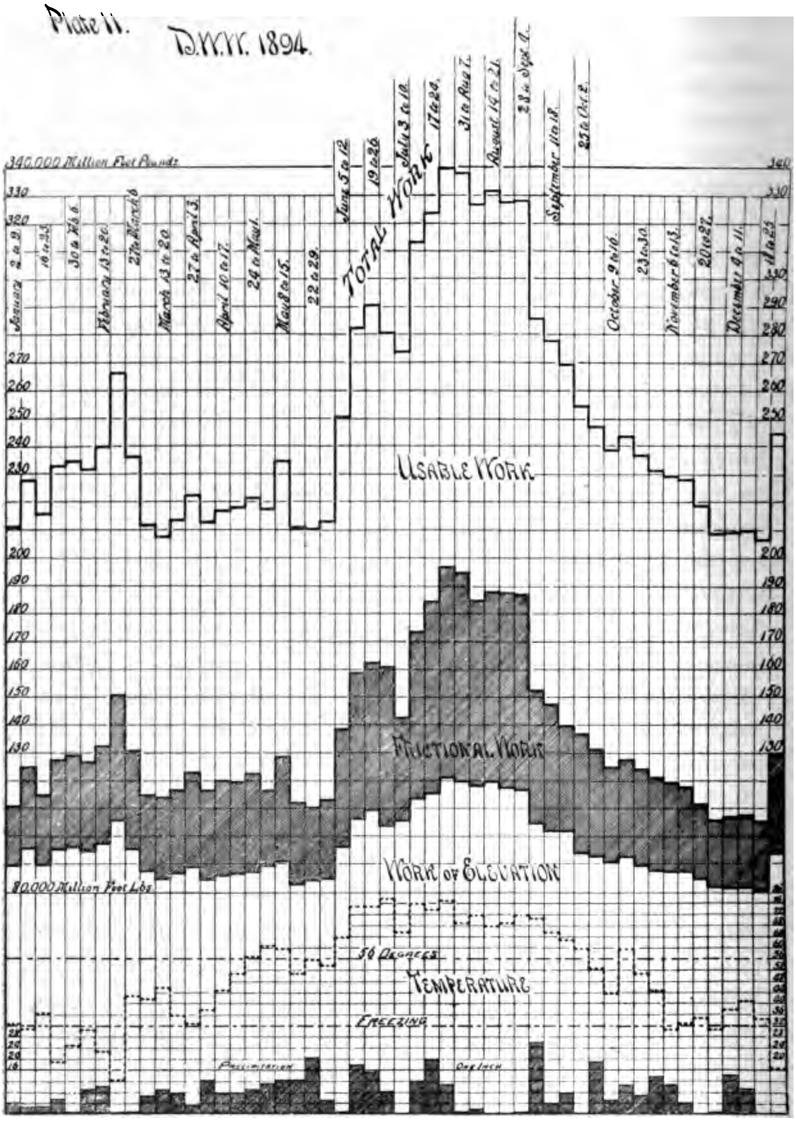
water assisted in bringing the efficiency to near its maximum. Cooler weather and a decreasing consumption, causing the engines to be run at less economical rates, together with the idleness of Engine No. 4 during most of both months combined to lower the line by successive steps in October and November. The working of the new engine, which ran more than thirty days out of the thirty-five credited to December, accounts for the increased economy with which the year closed.

From the foregoing it appears that the running of Engine No. 4 tends to greatly reduce the fuel bill. A closer examination of the records shows that when two engines are running and doing equal amounts of work, if Engine No. 4 is one of them, the fuel consumed is nearly 20 per cent. less than when it is not. This means that if all our engines were as economical as the new one, our fuel bills would be only about 60 per cent. of what they are at present. The cost of fuel for 1894 was $29,283.00. During the year Engine No. 4 has run less than one-fourth of the time. If, while running, it caused a saving of 20 per cent. the total saving due to it would be 5 per cent. of the year's fuel, so that if it had not run at all the fuel bill would have been over $30,000.00. A saving of 40 per cent. of this would amount to $12,000.00, which at 4 per cent. is the interest on $300,000.00. This sum would be just about sufficient to replace the three old engines and their boilers, and if this were done the saving in fuel would pay the interest on the investment, leaving the proceeds of the sale of the old machinery as clear gain. It will be noted, however, that during the greater part of the year one engine, in addition to the new one, is sufficient for the demand. Such an additional engine could be obtained and housed for about $125,000.00. The interest on this at 4 per cent. would be $5,000.00. By such an arrangement a saving in fuel of about $10,000.00 per year would be effected, leaving a net gain of $5,000.00 per year after the interest on the investment is paid to apply on the cost.

Referring again to Plate I, page 42, the ordinates to the full irregular line about the middle of the diagram, measured from the bottom of the plate represent the average daily Usable Work of one gallon of oil at the indicated periods, beginning with January, 1893. It will be noted that there is an abrupt increase in this work in February, the cause of which is not wholly apparent from the information at hand. From February to August there is a steady gain in the work of the oil, due partially to the warmer weather and to the manipulations of the system in March and June before mentioned, as well as to some changes in the methods of burning the oil. In August the rise is to be accounted for largely, if not wholly, by the completion of the Michigan avenue twenty-four-inch line. The record for September, from the explanations previously given, is erroneous as to the Usable Work, for a part of the water figured as used was in reality wasted at the engines, and if a correction were made for this it would bring the line for the month to about the same position as that of the month preceding, which would be in entire harmony with other data. The October line shows an increase in the Usable Work over August, due to the completion of the Park street extension, and the fact that less water being pumped, the frictional losses were less, and consequently the pressure on the distribution, though not on the engines, was increased. In November the decreasing friction tended to more than compensate for the colder weather and reduced pumping, and the line rises above that of October. It will here be noted, that while the Usable Work of the system per gallon of oil has increased, the work at the engines has decreased. This is due to the decrease in frictional resistances. The increasing colder weather in December caused the line of Usable Work to fall with that of the work of the engines. In January, February, March, April and May, 1894, the fluctuations in the lower line are but the reflections of those of the upper line. In June increasing consumption increased the friction, and hence reduced the head over the city, so that the Usable Work was decreased for the month, and still further fell in July and August, when the maximum quantity of water was pumped. It is worthy of notice, that while the work of the oil at the engines was not materially greater in June and July, 1894, than in the same months of 1893, the Usable Work shows a very decided increase which can only be accounted for by the improvement of the distribution system. September, October, November and December, on account of decreasing consumption and reduced friction, show gains in the Usable Work, and close the year with an increase of 48 per cent. since the beginning of 1893. Comparing June, '94, with June,'93, there appears an increase in the Usable Work per gallon of oil consumed of 28 per cent., of which 5 per cent. was at the engines, and 23 per cent. in the distribution. Comparing December, '94, with December, '93, there is a gain of 18 per cent., of which 7 per cent. was at the engines, and 11 per cent. in the distribution. Again, comparing the system at times of maximum consumption, July, '94, and July, '93, shows an increase of over 19 per cent., of which 7 per cent. is at the engines and 12 per cent. in the distribution system. Now, comparing the frictional areas for the several months of 1894 with those of 1893, it will be seen, that in every case, except July, the friction has been decreased, and that it was not decreased in July was due to the enormous quantity of water forced through our system during that month. The entire work of the system, by weeks, for 1894, is shown by Plate II, page 46. These results reflect great credit upon the management at the pumping station, and had it not been for the cordial co-operation of the Chief Engineer such satisfactory ones could not have been obtained.

The operations which have led to these improvements in our distribution system were partially described in the Report of last year. The continuation of the work this year has embraced the curing of about one hundred and fifty pre-existing dead ends, the making of over thirty connections between mains previously crossing, but not connected, the laying of a sixteen-inch cross-town line, with ten-inch and eight-inch branches in the northern part of the city, and a twelve and ten-inch line, with eight-inch branches connecting the Mullett street and the Watson street mains ; all of which construction, including that of 1893, except the connections, and mains less

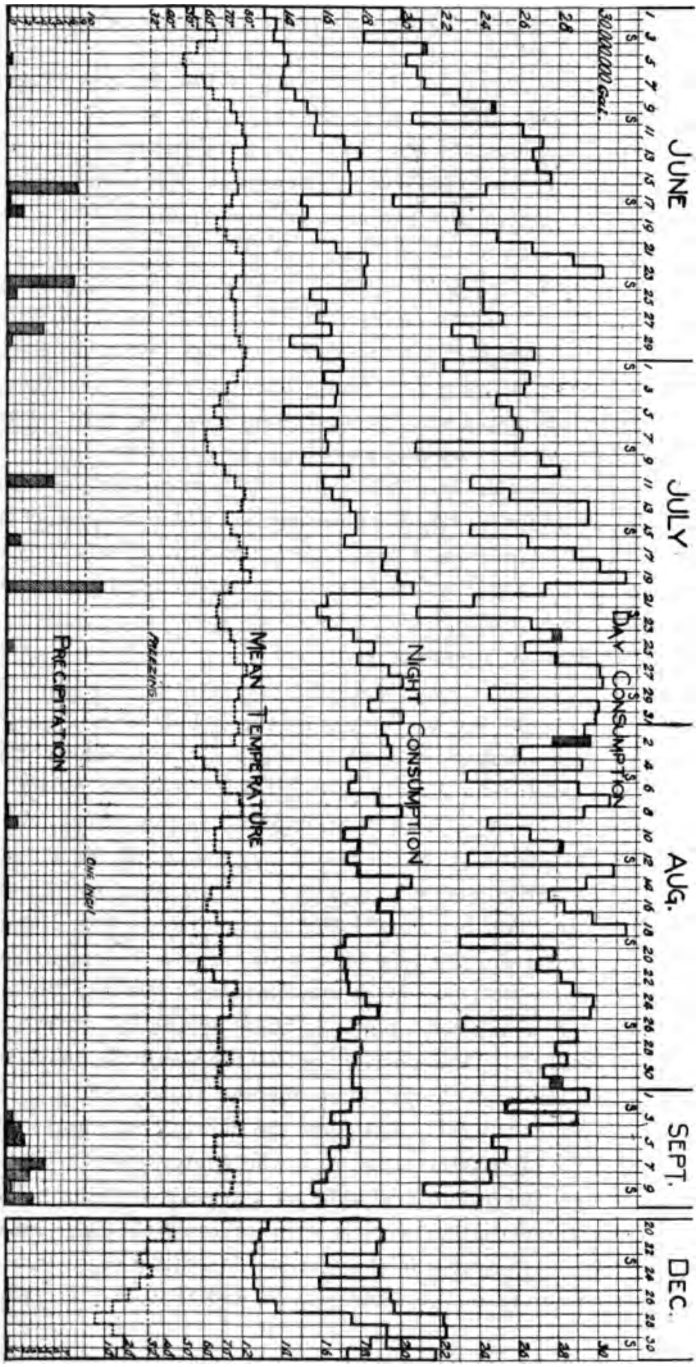
Plate 11.



than eight inches in size, is shown by broken lines on the map opposite page 52. There has further been completed, during the year, under your Engineer's supervision the laying of the ten-inch main for the supply of Belle Isle Park, the laying of an eight and six-inch extension in the township of Grosse Pointe, to the grounds of the Detroit Driving Club, and beyond to the Marshland road, and in the township of Hamtramck, a six-inch extension on the Norris Plank Road to Forest Lawn Cemetery. Some changes in the strainers of the intake conduits, and in the strainer wells at the pumping station, as well as some alterations in the suction conduit of the new engine, were also, in part, carried on under his direction, all of which come more properly in the reports of other departments.

An investigation into the conditions of flow in our distribution, demonstrated that, at the period of minimum consumption, the average head expended in overcoming the frictional resistances of the entire system was a little less than eight *per cent.* of the whole head pumped against, and at times of maximum draught this was increased to thirty *per cent.*, while the average for the year has been about sixteen *per cent.* Of this, in all cases, two-thirds is lost in that part of the system east of Mt. Elliott avenue. The frictional loss between the engines and Mt. Elliott avenue is greater than that from Mt. Elliott avenue to the intersection of Grand River avenue and Sixteenth street. The existence of these conditions, together with the fact that if one of the two forty-two-inch mains now conveying the water to the city should be disabled, the other would be inadequate to protect the city in case of fire, or even to supply the full domestic requirements, led to the recommendation of an additional force-main from the pumping station, which is to unite with the present system at the intersection of Champlain and Chene streets, thus providing for a stronger flow of water through the Mullett street thirty-inch main and its branches in the district midway between the former upper and lower mains. Owing to the demands for increased pressure in the business portions of the city, the former low service has been practically done away with east of Sixth street, so that no gates are now kept closed in the system except those along the 130-foot contour line running northwest from the intersection of Bagg and Sixth streets, as shown on the map opposite page 52.

We now come to the consideration of the water consumed. This at some periods of the year is very intimately affected by the temperature, and also at certain times by the amount of moisture precipitated from the atmosphere. While during the spring and fall the effect of the temperature is insignificant, it becomes more noticeable when the mercury rises above 55 deg., Fahr., or falls below the freezing point. In the former case the consumption is increased by lawn and street sprinkling, and in the latter by consumers leaving the fixtures open in order that the water may be kept in motion and thereby prevented from freezing in the service pipes. During the cold weather, as might be expected, the precipitation has no very apparent effect on the consumption, but during the hot months a rain or hail storm will very materially decrease it. To consider these effects more closely, refer to Plate III, page 49, in which the ordinates measured from the base of the diagram to the top line show the quantity of water consumed during the twelve hours from 7 A. M. to 7 P. M., and ordinates to the second line represent the consumption during the twelve hours of the night preceding. The lowest irregular line gives the mean daily temperature, and the small cross-hatched areas at the bottom show the amount of precipitation. Following the lines of consumption on the plate and neglecting Sundays which are marked S, it is seen that the fluctuations of the day and night consumption follow very closely the variations of temperature. The effect of rain may be especially noted on June 16, July 10 and 20, August 9 and September 3 to 9, in all of which cases the change of temperature was slight. A consideration of the effect of the storm on July 20 gives an idea of the quantity of water that may be used for sprinkling and like purposes. The difference in consumption between Thursday, July 19, and Saturday, July 21, due almost entirely to the storm of July 20, and resulting fall of temperature, was nearly eleven million gallons. As a rain would not be likely to affect any other consumption than that for lawn and street sprinkling and cooling purposes this quantity must be very nearly the amount so used. Eleven million gallons is nearly half the daily capacity of the



DETROIT WATER WORKS

CONSUMPTION. TEMPERATURE

= 1894 =

Plate III.

new engine, is more than one-third of the entire average daily consumption during some of the spring and fall months, is nearly one-ninth of our entire pumping capacity, and is equal to the entire average daily consumption that would be required for all domestic and manufacturing purposes if there were no waste.

The effect of cold weather is shown at the extreme right of the diagram where comparing the consumption of Saturday, Dec. 22, when the mean temperature was just at freezing, and that of the Saturday following when the mercury averaged about 13 degrees above zero, Fahr., we find a difference of ten million gallons in the consumption of the twenty-four hours. There is this distinction between these two excesses: the former is mainly added to the day consumption when the system is most severely taxed, while the latter principally affects the demand during the night when there is pumping capacity to spare and so is the less significant in its effect upon the operation.

The small cross-hatched areas along the line of daily consumption in Plate III represent the quantity of water supplied by our works for fire extinguishing. The largest quantity is that used on August 2, when occurred the Richards' Mill fire and a fire in the Michigan Central flour sheds, requiring the services of eight and five engines respectively; the total amount used in these two fires being about two million gallons.

The variations in the yearly consumption by seasons are shown in Plate IV, Figs. 1 and 2, page 51. In Fig. 1, ordinates measured from the base of the diagram to the upper irregular line represent the hourly consumption of water during the week of maximum demand, that beginning July 24; the ordinates to the lower irregular line represent the hourly supply during the week of minimum demand in the spring. In Fig. 2 the upper irregular line gives the hourly consumption during the week of maximum usage in the winter, and the lower line that for the minimum week of the year, beginning Dec. 18. From these diagrams it is seen at once that the maximum hourly consumption in the summer is a little more than twice the minimum in the same season, and that in the spring and

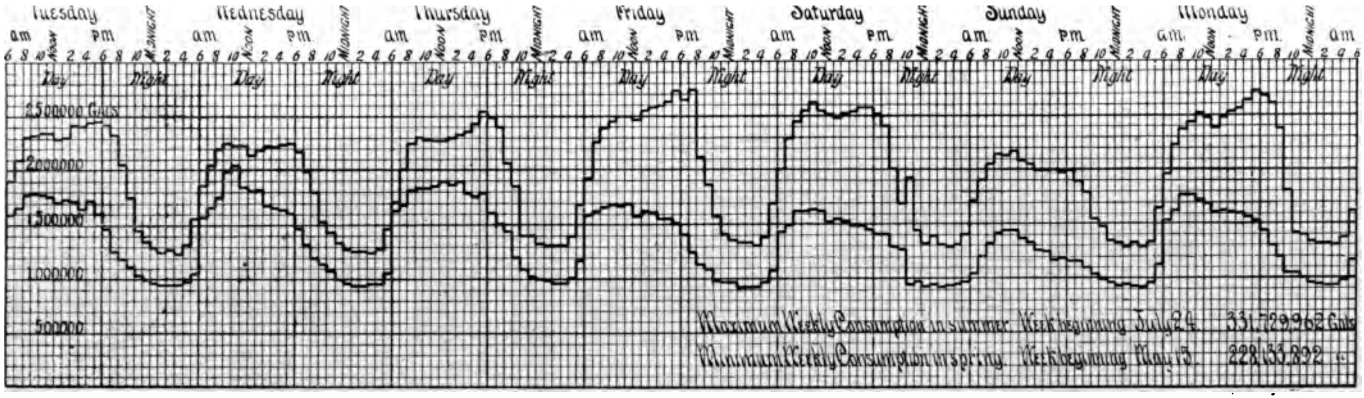


Fig. 2.

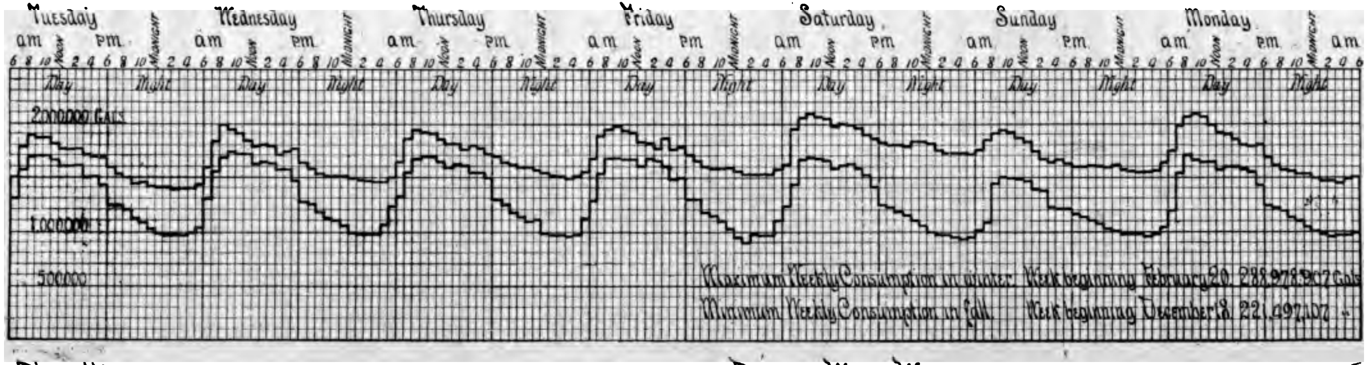


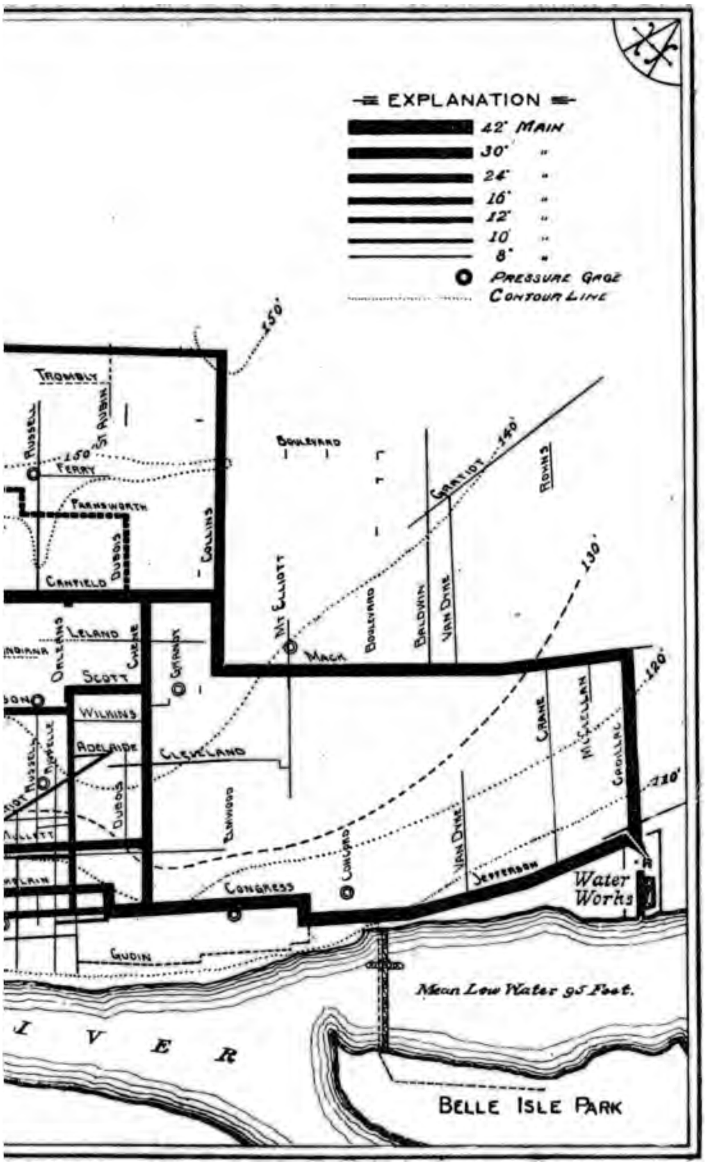
Plate IV.

DETROIT WATER WORKS. WEEKLY CONSUMPTION by Hours 1894 fall the former is slightly less than two times the latter, while, during the winter, the minimum may rise to three-fourths of the maximum.

From the fact that the hourly consumption between one and four o'clock in the morning averages half as much as the greatest hourly quantity used in the day for three-fourths of the year, and in those seasons when there is no especial reason for night usage, it is very evident that there must constantly be a vast quantity of water running to waste from our system, either through defective construction, or the carelessness of the consumers, or both. Just what this waste really amounts to can only be approximated, but the fact stands, that about 900,000 gallons is the least quantity registered in one hour, during the past two years.

The per capita consumption for the year 1894 has fallen below that of last year, and, on the basis of the number of consumers, is less than that of 1892, and is therefore at the lowest point reached since Detroit attained the unenviable distinction of wasting more water per inhabitant than any other large city in the world. The causes of the decrease from last year's consumption are to be found very largely in the milder winter of 1894, and in the introduction, by the Chief Engineer at the Pumping Station, of a device for avoiding the necessity of wasting water at the engines at those times when two engines pump too much, and one engine not enough, for the demand. The consumption for January, February and March, 1893, exceeded that of the same months for 1894 by over four hundred and forty million gallons. The saving at the engines appears to have averaged about a million gallons a day for half of the year. The combined effect of these causes, amounting to a per capita reduction of about six gallons per day, was in part counteracted by the extremely hot and dry weather of July and August, so that the reduction in the daily consumption is, as elsewhere shown, only about four gallons per inhabitant.

The work of the Draughting Room during the year has added greatly to the utility of the records of our system.


EXPLANATION
42" MAIN
30" "
24" "
16" "
12" "
10" "
8" "
PRESSURE GAGE
CONTOUR LINE
150'
TROMBLY
RUSSELL
ST AUBIN
150
FERRY
FARNSWORTH
DUBOIS
COLLINS
CANFIELD
BOULEVARD
GRATIOT
140'
ROHNS
MT ELLIOTT
BOULEVARD
BALDWIN
VAN DYKE
130'
LELAND
ORLEANS
CHENE
GRANDY
SCOTT
MACK
WILKINS
ADELAIDE
CLEVELAND
RIVARD
DUBOIS
ELMWOOD
CRANE
McCLELLAN
CADILLAC
120'
110'
VAN DYKE
CONCORD
JEFFERSON
CONGRESS
Water Works
GUOIN
Mean Low Water 95 Feet.
I V E R
BELLE ISLE PARK

About one-half of the city is now mapped, nearly two thousand drawings having been added during the year, making a total of over three thousand street intersections platted and bound for reference. Besides this, the office has furnished working plans and drawings of "shut offs" for the laying of nearly forty miles of pipe during the season. The force has consisted of the Chief Draughtsman and three assistants, one of whom has been employed nearly the entire time correcting our own and the assessor's maps. The many errors and omissions found in the field notes and foremen's reports of previous construction, has led recently to the transfer to this Department of the keeping of all such records, and a marked improvement is already noticeable. The record of pipeage, as published at the end of this report, has been considerably rearranged since last year. Pipe in east and west alleys is now to be looked for under the heading of the street next north, and pipe in north and south alleys west of Woodward avenue will be found with the street next east, while in those east of Woodward avenue it will be found with the street next west; hence, the alleys adjacent to Woodward avenue will be found with that street. A very few exceptions, and only in cases of diagonal streets, have been made to the above rule. The Boulevard pipeage should now be looked for under the head of the street with which the portion in question is in line; and, finally, all pipeage is read from west to east, or from south to north.

In closing this report, it is pleasing to testify to the cordial and hearty co-operation that has been tendered me by all my associates. Thanks are due to the officer in charge of the local station of the United States Weather Bureau, and to the several City Departments, for many courtesies and valuable information during the past year.

All of which is, gentlemen, very respectfully submitted.

G. S. WILLIAMS,
Civil Engineer.

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

DETROIT, January 2, 1895.

To the Board of Water Commissioners:

GENTLEMEN—In compliance with the rules and regulations of your honorable body, I herewith report the work done in the Meter, Inspection, Service Cocks and Repairing Leaks Departments during the year 1894.

The following tables show the number of meters placed, the number removed, and the total number in service December 31st, 1894:

Placed in 1894.

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Total number placed during the year..................	397	138	94	49	31	6	5	2	722

Removed in 1894.

	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Service connections discontinued...	21	8	8	......	1	......	......	38
Premises vacant........................	24	3	4	1	1	......	......	33
For repairs, and replaced with other meters	15	......	4	1	3	1	1	25
Too small for required supply......	......	1	4	3	1	......	......	9
Too large for required supply........	......	1	1	5	2	......	1	10
	60	13	21	10	8	1	2	115

Meters in Service Jan. 1, 1895.

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
In service Jan. 1, 1894	1,212	552	525	85	119	58	26	2	2,579
Placed during the year, and in service Jan. 1, 1895	337	125	73	39	23	5	3	2	607
Total number in service Jan. 1, 1895	1,549	677	598	124	142	63	29	4	3,186

The following tables show the kind and sizes of meters placed during the year, also those removed:

Placed in 1894.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thompson	366	136	78	46	28	6	4	2	666
Crown	3	1	3	1	......	......	......	......	8
Hersey	......	1	12	2	......	......	1	......	16
Worthington	1	......	1	......	2	......	......	......	4
Buffalo	1	......	......	......	......	......	......	......	1
Trident	25	......	......	......	......	......	......	......	25
Union Rotary	1	......	......	......	1	......	......	......	2
	397	138	94	49	31	6	5	2	722

Removed in 1894.

KIND.	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Thompson	38	13	11	8	3	......	1	74
Crown	5	......	2	1	......	......	......	8
Hersey	......	......	6	......	2	......	1	9
Worthington	2	......	1	1	2	1	......	7
Union Rotary	3	......	......	......	1	......	......	4
Neptune	4	......	1	......	......	......	......	5
Trident	8	......	......	......	......	......	......	8
	60	13	21	10	8	1	2	115

The following table shows the total number of **meters in** service, and the different kinds and sizes, also **indicators** attached to hydraulic elevators:

In Service Jan. 1, 1895.

KIND.	SIZES.									
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Indi-cat'rs	Total
Thompson	1,447	652	485	106	104	44	13	4	......	2,855
Crown	38	16	47	11	13	9	4	......	......	138
Hersey	2	4	44	3	11	2	8	......	......	74
Worthington	14	4	17	1	12	8	3	......	......	59
Union Rotary	9	......	1	2	2	1	1	......	....	16
Neptune	21	......	......	......	1	......	......	......	......	22
Trident	17	......	......	......	......	......	......	......	......	17
Duplex	......	......	2	......	......	......	......	......	......	2
Equitable	......	......	1	......	......	......	......	......	......	1
Ball & Fitts	......	......	1	......	......	......	......	......	......	1
Buffalo	......	1	......	......	......	......	......	......	......	1
Indicators	......	......	......	......	......	......	......	......	9	9
	1,549	676	598	123	143	64	29	4	9	3,195

Meters in Stock.

KIND.	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Thompson	......	8	3	1	4	2	2	20
Crown	......	......	1	1	......	......	......	2
Hersey	......	......	3	......	2	......	......	5
Worthington	......	......	1	......	......	......	......	1
Union Rotary	1	......	6	......	......	......	......	7
Trident	8	......	......	......	......	......	......	8
Neptune	6	......	1	......	......	......	......	7
	15	8	15	2	6	2	2	50

Tools and Material on hand.

Valuation of meters in stock January 1, 1895	$990 00
Valuation of material on hand January 1, 1895	271 14
Valuation of tools January 1, 1895	377 08
Valuation of horses, wagons, bicycles, etc., January 1, 1895,	453 00
	$2,091 22

Meters in Service.

Valuation of meters in service, Jan. 1, 1894	$77,571 87
Deduct 10 per cent. for depreciation in value	7,757 18
	$69,814 69
Add amount expended during the year for meters placed	17,913 54
	$87,728 23
Less stock on hand Jan. 1, 1895	2,091 20
Total valuation of meters in service Jan. 1, 1895	$85,637 03

Cost of material used in repairing meters in 1894	$126 22
Cost of labor in repairing meters in 1894	903 25
Total cost of repairs	$1,029 47

Summary of total amount expended in meter department for the years 1889 to 1894, inclusive:

	1889	1890	1891	1892	1893	1894	Total
Meters	$11,175 00	$18,700 00	$6,501 55	$12,371 82	$6,987 48	$8,824 08	$64,559 88
Supt. and labor	1,734 10	8,510 57	4,841 49	8,269 17	8,980 48	6,672 20	39,008 01
Material, tools, etc	637 26	2,982 14	872 99	2,132 93	1,650 33	1,833 01	10,108 66
Freight, hauling, etc	98 05	408 97	197 11	244 08	165 12	201 18	1,314 51
Horse, wagon, etc	....	....	.. ..	547 24	184 50	383 07	1,114 81
Total	$13,644 41	$30,601 68	$12,413 14	$23,565 24	$17,967 86	$17,913 54	$116,105 87

Six hundred and seven meters have been placed during the past year, and 412 of them at the request of the consumer, showing that the meter is being looked upon at the present time with much favor, rather than with fear and distrust as was the case when they were first introduced, and they certainly will continue to increase in favor as the benefits derived from their use, both to the consumer and the water department, becomes more generally known.

We have now a total of 3,186 meters in service, and are deriving the same satisfactory results as in former years. They are the greatest "leak detectors" known to-day, and it requires no effort on our part to have leaks repaired on metered connections, as the consumer is only too glad to have an opportunity of reducing his water bill when he knows how to accomplish it.

In metering the public buildings, hospitals, charitable institutions, etc., during the past season, we have found the source of an immense consumption of water, and without doubt a large proportion of it is needless waste. For instance, the consumption at the City Hall is 2,433,500 gallons per month, or nearly 3,000 barrels per day. The Eastern and Western markets consume 1,500,000 gallons per month, an amount that would seem to be far in excess of any reasonable demand. On one of the school buildings the meter showed a consumption of 2,112,000 gallons the first month it was in service, and the same school consumed only 435,500 gallons last month, showing a reduction of 1,676,500 gallons, the effect of paying by meter measurement. There are 54 school buildings metered, and although the reduction has not been in the same proportion in every instance, still it has been large. There are a few still where the consumption seems to be far beyond any reason therefor. The High School, for instance, 1,800,000 gallons, Houghton School, 1,225,000, and Tappan School, 1,500,000 gallons monthly, at least four times as much as there is any possible necessity of using.

The consumption in the different hospitals is enormous in comparison with what they should use legitimately. Take the "Harper," for an illustration, an institution containing, on an average, 150 persons, and their consumption the first month after placing meter, was 2,812,500 gallons, which is a daily per capita consumption of 625 gallons, and at the regular rate would amount to over $1,100 per annum, being more than the Water Works receive from all the charitable institutions in the city. If the balance of the city—with the free and unrestricted use of water, should use it in the same proportion—estimating the population at 250,000—there would have to be pumped into the mains daily, 156,250,000 gallons for family purposes alone, and to that would have to be added the amount used in stores, factories, livery stables, saloons, breweries, etc., which would be very nearly as much more (as experience has shown such places have been the most reckless in the waste of water), making upwards of 300,000,000 gallons daily, or about three times the capacity of the present works. Their daily per capita rate in December was 447 gallons, a per capita reduction of 78 gallons. Grace Hospital, with an average number of 135 persons, during 26 days in November, used 1,925,250 gallons, being 548 gallons per day for each person. Their per capita rate in December was 491 gallons, being a reduction of 57 gallons.

The city pays $1,000 per year for all water used for charitable purposes, an amount that was fixed several years ago, when such institutions were less numerous, and not nearly so pretentious as many of them are at present, and as the most of them are not altogether charitable, I should think the Water Works should receive an amount equal to the cost of furnishing the water, whether the city or the institutions themselves pay for it, but in any event, there should be a limit to their consumption, and the only practicable way that I can see to arrive at it, is to have a stated price for a stated quantity; let the price be the smallest consistent amount, but whatever it is, it will have a tendency to stop the waste, as there will then be an incentive to look after the leakage. Without something of the kind is done, the extravagant consumption will still continue.

The meter has demonstrated that the enormous use of water in many of the public and charitable institutions is largely in excess of their legitimate uses or necessities, and it seems as though on such places as your honorable body furnish water without charge, the quantity should be limited to a reasonable allowance, and all over that to be paid for at the regular rates. It could be arrived at by comparing their consumption during the time the meter was in position and when the occupants were supposed or expected to pay for the amount consumed; said consumption would probably be about what they ought to use legitimately, which is much less than what it has been since they have understood that the water would be furnished without charge. For instance, why should Mt. Elliott Cemetery consume 204,750 gallons in October and 572,250 in December? If they were obliged to pay for all they used over 200,000 gallons monthly (which is an exorbitant quantity), they would probably confine their consumption to that amount, and by so doing, the Water Works would save 272,000 gallons per month in this one instance alone. Elmwood Cemetery consumed 1,223,250 gallons in November, and very nearly 1,000,000 gallons in December, the necessities of which I am unable to explain.

Police headquarters consumed 262,500 gallons in July and 448,500 gallons in October, and 421,500 gallons in November. The only explanation for the large increase since July is the fact that then they had to pay for the water, and since that time it has been free.

The Elmwood Ave. police station consumed 108,750 gallons in July and 214,500 gallons in December, very nearly double, when from the very nature of things, it should have been much less in December, than it was in July. All of which proves, that to stop waste effectually, there must be a charge for the quantity consumed, which never fails to produce the desired results.

The works are still pumping about 140 gallons daily per capita. On metered premises—that is private families with all modern fixtures such as baths, closets, etc.—the average quantity consumed daily per capita is about 50 gallons, that is on single houses, and in modern flats where from eight to twenty-four families take water through one meter, the consumption is only 40 gallons. Tenement houses where there are no fixtures except the ordinary hydrant, the consumption is 17 gallons, so that for family use the quantity pumped ought not to exceed on an average over 36 gallons daily per capita. Basing our population at 250,000, it shows that 9,000,000 gallons daily would supply the city for family purposes, were the waste reduced to a minimum. Very nearly all of the business places are metered, and as they show a consumption of about 5,000,000 gallons daily, to which may be added 1,000,000 gallons for small stores, factories, etc., not metered, it appears that about 16,000,000 gallons would be a fair estimate for the daily supply of the city, instead of from 31,000,000 to 52,000,000 gallons, as we have been pumping.

The resolution passed by your honorable body allowing hose connections placed outside of the meter, so that lawn sprinkling should be free, as is the case with unmetered water, is causing some friction. In some cases the lawn is hardly large enough to be called by that name, and at the same time is situated behind the house, or on the side, where by attaching a hose it can be taken into the barn for carriage washing and all uses about the premises, such as flushing closets, washing windows, etc. While the majority will be perfectly honest, and use it for lawn purposes only, there are some who think that public property is legitimate picking, and do not hesitate or allow their conscience to prevent them from keeping their meter bills at the minimum amount each month.

The expense for the care of meters increases in proportion to the number in service. One thing that has caused us much trouble has been the changing of the street mains in different localities from smaller to larger ones. The water being shut off in the main pipes changes the current in the locality in which they are operating, sending it in a different direction, thereby stirring up the sediment in the pipe which is drawn into the service connections, and not only stopping the meter, but often the whole service pipe is filled with it. By the use of the large "Smith-Topping Machine" purchased last season, many of the connections can now be made under pressure, and the above difficulty will be obviated to a large extent. Another cause of trouble has been the hemp packing that has been allowed to get into the pipes while the joints were being calked. It has been the means of shutting off the supply of water on many metered and unmetered service connections, which has caused much annoyance and expense in removing it. Some of our wooden wells that were built five or six years ago are beginning to decay, and where they are outside of the lot line, we are obliged to replace them with brick, as the Board of

Public Works will not allow any more wood put in. It costs a little more to use brick, but in the end it will have been a good investment, as they will require no further attention for many years. At present, nearly all meters are placed at the request of the consumer, and he is obliged to build the well in case one is necessary, so that in the future our only expense for wells will be to replace those we have already built, and at a time when we had to force the placing of the meter.

INSPECTION.

The five leak examiners have made 55,603 examinations during the last year, and reported 4,163 leaks, 3,890 of which were repaired within the time given for same, and 273 were ordered shut off for failure to make the necessary repairs.

The percentage of leaks to number of examinations made was 7.48, being a slight reduction compared with the year 1893, when it was 7.77 per cent.

In many places the water is found running continually, for which different excuses are given; at this season of the year the principal one is to prevent freezing, something that it seems almost impossible to prevent by any other means than a meter, for although fair promises are made to the examiner to prevent him ordering the water shut off, the moment his back is turned the water is running again in the majority of cases.

The increased pressure on the mains has caused many leaks, owing largely to old and worn out service pipes which have been in the ground for many years. Being of a lighter grade than what is being used at the present time, they are giving away under the increased pressure, and it will probably be a source of considerable trouble for some time to come, as there are many of the old connections which will have to be replaced with stronger service pipes in the near future, especially so, if there is any further increase of pressure.

Where leaks are discovered, the occupant is given a stated time to make the necessary repairs, and at the expiration of the time the premises are examined again. If repairs are not made, the water is ordered shut off, unless there is some good reason for not doing so. In most cases, however, the repairs are promptly made, as will be seen by the small number ordered shut off, the percentage being 6½ of the whole number of leaks reported.

In addition to the foregoing work, the examiners read about 2,700 meters each month, and deliver all of the meter bills, with the exception of a few in the outskirts of the city, which are delivered by the service cocks inspectors.

SERVICE CONNECTIONS.

Two thousand and sixty-seven service connections have been made during the past year, consisting of 1,327 ⅝-inch, 693 1-inch, 21 2-inch, 12 3-inch, 12 4-inch, 1 6-inch, and 1 10-inch, which added to those previously inserted makes a total of 47,559 service connections in the city on January 1, 1895. In addition to the above we have inserted 939 ⅝-inch and 485 1-inch service cocks for the Iron Pipe Department on streets where the old mains have been discontinued and larger ones put in their places. In such cases we have been obliged to connect all of the old service pipes to the new mains, making a total of 1,424 service cocks inserted for the Iron Pipe Department.

All service cocks are now inserted with the Muehler tapping machines which were purchased in 1893, the necessities for which were fully explained in my last annual report. These machines insert the cock with a screw or thread, and with their use the old drive cock has been entirely abandoned. We were under the impression that the "drive cocks" were a source of large waste, as such a large percentage of them were supposed to be leaking, but upon examination of several of the old mains that were exposed during the past season, preparatory to changing them, and while they were under pressure, the writer examined many of the connections and was surprised to find so few of them leaking; and on keeping a record from July 12 to August 30, we find that there were 462 old service cocks taken out, only three of which were leaking, a little over six-tenths of one per cent. However the Muehler cock is a great improvement over the other, as there is no possibility of them being blown out with an increase of pressure or from any other cause whatever.

There have been one 2-inch, three 4-inch, one 6-inch and one 10-inch service connections made for as many different manufacturing institutions to furnish water for automatic fire sprinklers, and there being no charge for water used for fire purposes, acting under instructions from the General Superintendent, I have required the parties making such connection to sign an agreement wherein said service is to be kept separate and independent, to be used for fire purposes only, and that no connection shall be taken therefrom for any other purpose whatever, and also to permit a thorough inspection of the system by the Water Board or its employes whenever it so desires. We have nineteen such connections on premises where their regular supply is metered and taken from a separate service, and in making examinations at different times we have only found one instance where the fire service had been tapped to get water that did not pass through the meter; the proprietor however claimed that it was done innocently by their engineer, who was not familiar with the premises, or with the agreement they had signed, and I have no reason to doubt that such was a fact. Nevertheless, as the "automatic fire sprinkler" is getting to be quite popular, it is something that will demand considerable attention in the future.

We still derive the same satisfactory results from the use of the "Smith Tapping Machine" for making large connections under pressure. The largest connection we have made thus far was a 10-inch on the 42-inch main for an automatic fire sprinkler put in by the Detroit Stove Works, and the machine worked to perfection, making the cut in sixty minutes, which was considered good work, it being the first connection larger than a 6-inch that we have made with it. If we had been obliged to make this connection the old way we would have been compelled to shut off the 42-inch main in that locality, which of itself would have been quite a task, besides the inconvenience it would have caused a large number of water takers; then after cutting the pipe the enormous quantity of water to remove before the joint could be leaded would have been a task, the dimensions of which would have been exceedingly large, all of which was avoided by said machine.

The following statement will show the receipts and disbursements in the Service Cocks Department during the year 1894:

Receipts for service cocks	$5,281 00	
Receipts from plumbers' licenses	608 15	
Receipts from old service cocks	117 81	
Received from Park and Boulevard Commissioners	317 38	
Miscellaneous	1 00	
		$6,325 34
Total expense Service Cocks Department	$9,497 31	
Less labor of inspectors	3,391 02	
		6,106 29
Balance to credit of service cocks		$219 05

The following table shows the duties performed by the Inspectors of New Work during the year 1894:

INSPECTION OF NEW WORK.

INSPECTORS.	District.	Examined New Connections.	Examined Extensions & Fixtures.	Let on New Connections.	Notified for Building Tax.	Calls for Non-Payment.	Shut for Non-Payment.	Let on Vacants Re-occupied.	Shut for Vacancy and Request.	Examined for Assessors.	Meter Bills Delivered.	Totals.
John Hatzenbuhler....................	1	457	212	166	23	2,183	190	35	168	735	849	5,018
Robert Pelham, Jr......................	2	366	250	298	11	2,005	127	30	116	490	1,178	4,871
C. J. Skinner	3	462	432	144	87	2,982	137	86	248	508	947	5,983
*William Forsyth	4	8	21	5	1	83	5	33	67	49	133	405
*Frank Clark	5	8	24	8	5	119	......	39	87	42	82	414
Michael Hart..........................	6	245	329	242	67	1,843	418	35	104	352	1,306	4,941
John Becker	7	220	273	159	96	2,161	220	34	87	257	1,072	4,579
Adolph Jasnowski.......................	8	248	265	223	61	2,353	287	39	107	370	464	4,417
Totals..................	...	2,014	1,806	1,245	351	13,729	1,384	281	984	2,803	6,031	30,628

*New Inspectors appointed November 20th, 1894.

In addition to the foregoing work, the inspectors have devoted much time to locating and making a record of all stop-boxes throughout the city. They are taking new measurements, as there has been so much changing and subdividing of lots since the beginning of our record, that in many instances we find the location not properly recorded, and when the box happens to be covered up, it takes much valuable time to find it, especially so in case of bursted pipes. As stated in a former report, "It necessitates the utmost vigilance to keep the stop-boxes exposed to view. Sidewalks being repaired, new ones built, or change of grade in street, alley, or lot, the tendency is to pay very little attention to the stop-box, and it is usually covered up, as the majority of property owners can see very little use for it until there is an urgent request to shut off the water on account of bursted pipes, when they have a forcible reminder of its necessity." Not only that, but during the last year there have been 13,729 places reported to be shut off for non-payment, besides 984 to be shut off for vacancy, showing the need of keeping the boxes in sight at all times. A duty that will always exist, will be that of seeing that they are kept in proper condition, and as there about are 50,000 of them at present, one can readily see that it will require much time and watchfulness on the part of the inspectors in giving them the necessary attention.

The increase of work in this Department necessitated the appointment of two more inspectors, said appointments being made by your honorable body in November last. There are now eight inspection districts to correspond with the assessors, so that each assessor has an inspector to attend to that portion of the work that comes directly under his control, something that saves considerable friction, as formerly one inspector received orders from two assessors, and at times the orders were somewhat conflicting, as both assessors occasionally wanted the inspector at the same time, all of which is remedied by the present division.

PLUMBERS AND PLUMBING.

We have had very little trouble with the plumbers of late, as the majority of them follow very cheerfully the rules and regulations governing their work.

The rule adopted by your honorable body requiring all plumbers to pass an examination before the Board of Plumbing Examiners, and produce a certificate from the Board of Health, as to their competency, before a license would be granted them from this office, created some friction, as a number of plumbers who had previously received a license failed to pass a successful examination, and therefore we could not grant them a permit to do plumbing. However, as they were allowed to appear before the examiners several times, the most of them finally succeeded in getting a certificate, and those who did not, the money they paid for their licenses was returned to them, and they were obliged to go out of the business.

Owing to the amount of work done by apprentices, we find that first-class plumbers need fully as much watching as the poorer ones, and that is why I think that a rigid inspection of all plumbing (by thoroughly competent inspectors), both as to material and workmanship, would produce the desired results. The most of the plumbers have succeeded in squeezing through an examination, and getting a certificate, but after all it does not make good plumbers of them. Being obliged to tear out their work, when not properly done, and do it over again, is a splendid educator, and after doing it a few times, they will either do good work, or go out of the business, either of which ought to be satisfactory.

TABLE showing the number of taps made, and the different sizes, in each ward during the year 1894; also those discontinued.

NEW CONNECTIONS.	SIZES.	WARDS.																Total inserted.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Iron pipe	$\frac{5}{8}$-inch	15	9	131	23	205	39	71	38	152	40	135	54	97	66	150	99	1,324
" "	1-inch	52	41	37	62	26	53	24	55	15	41	29	34	52	67	83	22	693
" "	2-inch	2	8	...	...	...	...	1	1	...	...	1	...	1	...	1	2	17
" "	3-inch	2	1	...	2	...	...	...	1	...	...	...	...	...	1	1	...	8
" "	4-inch	4	2	1	1	...	2	1	...	1	2	...	...	...	...	2	1	17
" "	6-inch	...	..	...	...	...	...	...	...	1	...	...	...	...	...	1	...	2
" "	8-inch	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2
" "	10-inch	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
		75	62	169	88	231	94	97	95	169	83	165	88	150	134	240	124	2,064
DISCONTINUED CONNECTIONS.																		Total discontinued
Iron pipe	$\frac{5}{8}$-inch	7	8	2	3	2	4	1	...	...	...	...	...	...	...	4	...	31
" "	1-inch	5	7	...	...	...	...	1	2	1	7	...	1	...	2	...	...	26
Wood pipe..........	$\frac{5}{8}$-inch	...	3	129	11	143	...	43	7	104	...	66	...	13	...	...	...	519
" "	1-inch	8	1	16	11	17	...	7	5	3	...	9	...	7	...	...	...	84
		20	19	147	25	162	4	52	14	108	7	75	1	20	2	4	...	660

TABLE SHOWING NUMBER OF SERVICE CONNECTIONS IN USE JANUARY 1st, 1895.

Size of Connection.	No. in 1893.	Added in 1894.	Discontinued	Total January 1, 1895.
⅝ inch, Cast iron	35 028	1,324	31	**36,321**
1 " "	10,221	693	26	**10,888**
2 " "	120	17	....	**137**
3 " "	107	8	....	**115**
4 " "	73	17	....	**90**
6 " "	3	2	....	**5**
8 " "	......	2	....	**2**
10 " "	......	1	....	**1**
*Wood pipe	3,105	....	603	**2,502**
	48,657	2,064	660	**50,061**
Less error in wood pipe estimate				**2,502**
Aggregate				**47,559**

REPAIRING LEAKS.

The General Superintendent placed this department under my control last July; since that time we have had no serious leaks to contend with. During the year there have been eleven breaks reported in the main pipes, two of them were in the 30-inch, one in the 24-inch, two in the 6-inch, five in the 4-inch, and one in the 3-inch, all of which were repaired without difficulty. There were also found 38 leaking joints, seven of which were in the 42-inch, three in the 30-inch, five in the 24-inch, one in the 16-inch, one in the 10-inch, fourteen in the 6-inch, six in the 4-inch, and one in the 3-inch mains. Sixty-seven street gates were reported leaking, and were repaired as follows: One 24-inch, one 10-inch, three 8-inch, twenty-nine 6-inch, twenty-eight 4-inch, and five 3-inch. One new 6-inch gate was set to take the place of one that could not be repaired.

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*Many years ago there was an estimate made of the number of service connections attached to the wood mains, as previous to that time there was no record kept of the number of such connections. Since the estimate was made, however, there has been a record kept each year of the number added, and also those removed. During the last year all wood mains have been taken out, and with them 603 service connections, leaving 2,502, which number must have been an error in making the original estimate, and will therefore have to be deducted from the total number, as shown in our last Annual Report, making (after adding those inserted during the year 1894) a total of 47,559 service connections in use on January 1st, 1895.

Numerous leaks have been reported, which after being located, have been found to be on service connections, when they have either been shut off at the stop-box or at the main, as the necessities required, and then turned over to the owner or occupant for repairs.

All complaints of "bad water" have been given immediate attention. The complaints usually come from localities which get their supply from a pipe with a "dead end," and on which there is a "blow-off gate," the opening of which for a short time usually remedies the trouble, but, only temporarily, for as long as we have "dead ends," just so long will we get complaints of bad water, but as the number is gradually growing less, we hope the time is not far distant when they will all be done away with, as far as it is possible to do so. We have now 521 blow-off gates, (as against 667 the previous year), not all of which are on "dead ends" however, as many of them are permanently set at special points along the line of pipe.

We have had a great deal of trouble in this Department during the past season with "hemp" getting into the service pipes, as previously mentioned under the head of Meters. We have had to dig up fifty-six service connections, sometimes at the main, and at other times under the buildings, as it was liable to wedge itself into the pipe at any point between the main and faucet in the building. The foregoing trouble has occurred usually in the immediate vicinity of where the Iron Pipe Department were laying pipe, and was caused by some of the men allowing the packing to get into the pipe while they were calking the joints. As it only occurred on some special lines the fault was discovered, and since that time we have had very little trouble from that cause.

Owing largely to the efficiency and experience of our foreman, Mr. Wallace, the work in this Department has been done in the most satisfactory manner.

Attached to this report are complete lists of tools on hand, and an itemized account of material in stock in the Meter, Service Cocks and Repairing Leaks Departments on the 31st day of December, 1894.

In conclusion will say, that I think the men in the different departments over which I have charge, are entitled to much credit for the faithfulness with which they have done their work, all of them having shown a desire to give their best services to the works, to which they (the works) are entitled.

Thanking your honorable body for the very courteous and considerate manner extended me upon all occasions, the foregoing report is respectfully submitted.

T. R. PUTNAM,
Sup't Meters and Inspection.

REPORT OF CHIEF ENGINEER AT PUMPING WORKS.

DETROIT, January 1, 1895.

To the Board of Water Commissioners:

GENTLEMEN — I have the honor to submit the Engineer's report for the year 1894.

The following table shows the number of gallons of water pumped, and cost of fuel for the years named:

YEAR.	GALLONS OF WATER PUMPED.	COST OF FUEL CONSUMED.	AVERAGE DAILY DELIVERED.
1852	235,840,271	....	646,411
1853	303,531,743	$2,129 37	931,594
1854	376,265,126	2,271 34	1,030,866
1855	542,807,364	3,325 81	1,487,143
1856	692,124,305	4,017 44	1,896,231
1857	697,190,523	3,993 20	1,909,837
1858	718,091,207	3,655 20	1,967,373
1859	782,112,587	3,194 15	2,142,774
1860	870,036,451	4,196 21	2,383,580
1861	895,129,423	4,414 07	2,452,409
1862	994,945,329	3.150 95	2,725,878
1863	1,035,798,043	4,670 86	2,837,803
1864	1,018,390,256	7,647 62	2,839,078
1865	1,049,514,887	7,372 89	2,875,383
1866	1,196,317,922	9,349 16	3,277,583
1867	1,425,535,280	10,121 82	3,905,576
1868	1,666,545,125	11,379 23	4,507,248
1869	1,946,810,325	11,247 92	4,511,809
1870	1,866,060,068	12,713 78	5,112,493
1871	2,300,150,605	14,681 05	6,301,782
1872	2,782,292,578	17,736 86	7,601,892
1873	3,198,393,948	20,233 30	8,762,723
1874	3,289,872,635	20,431 71	9,013,350
1875	4,207,454,260	21,393 98	11,527,272
1876	4,065,134,470	19,832 89	11,107,499
1877	4,213,239,790	17,433 72	11,543,123
1878	4,345,743,330	10,943 82	11,906,146
1879	5,129,599,110	11,219 51	14,053,696
1880	5,552,965,310	12,276 60	15,172,036
1881	6,543,127,968	16,556 63	17,926,377
1882	6,284,000,742	13,156 16	17,261,440
1883	7,379,327,188	16,495 99	20,217,334
1884	8,510,614,140	19,877 07	23,253,044
1885	9,970,829,580	21,341 48	27,317,341
1886	10,576,571,254	20,387 24	28,976,907
1887	13,168,859,808	35,882 83	36,079,166
1888	14,380,166,670	39,568 66	39,397,716
1889	12,875,334,453	34,413 31	35,274,888
1890	12,120,944,532	31,852 40	33,209,067
1891	12,057,261,236	33,826 86	33,033,592
1892	12,476,612,482	31,031 40	34,182,499
1893	13,877,977,208	27,479 93	38,021,855
1894	13,649,779,605	29,283 47	37,396,656

The following tables show in detail the work done by each engine each month of the year.

ENGINE No. 1.

MONTHS.	Time run.		Revolutions.	Gallons Water.	Gallons of Oil.	Cost of Oil	Duty.
	H.	M.					
January	573	....	276,174	427,517,352	56,873	$893 10	71,469,132
February.......	672	....	339,694	525,846,312	71,486	1,150 11	70,600,145
March	230	....	170,708	264,255,984	34,880	561 56	72,662,819
April	91	25	47,972	74,260,656	9,900	159 39	71,942,823
May	361	30	184,576	270,702,342	32,596	524 80	79,651,066
June	167	05	139,601	186,243,378	24,690	397 51	74,234,845
July	512	25	288,605	390,467,028	52,356	827 46	74,016,887
August.........	177	10	100,937	156,250,476	22,212	344 28	70,401,348
September....	360	10	195,305	252,968,256	35,469	549 77	70,188,367
October........	634	10	321,808	413,371,044	58,350	904 42	69,127,540
November	511	40	299,768	361,181,412	53,976	836 62	64,736,428
December.....	724	10	365,704	458,779,806	62,573	969 88	67,874,453
Total	5,014	45	2,730,847	3,781,844,046	515,311	$8,118 90	....

ENGINE No. 2.

January	620	55	306,326	419,881,764	55,857	$877 15	71,469,428
February.......	672	....	343,626	552,550,608	75,060	1,208 46	70,603,688
March..........	540	40	289,433	347,378,652	45,852	738 21	72,662,231
April	425	....	249,059	200,243,436	26,697	429 82	71,938,588
May	352	45	183,838	228,342,072	27,494	442 65	79,654,790
June	395	55	227,479	295,457,424	39,169	630 62	74,233,595
July.	493	50	275,454	315,893,232	42,365	669 56	74,002,454
August.........	744	... .	404,948	483,745,008	68,772	1,065 96	70,396,673
September	369	....	204,982	261,491,928	36,666	568 32	70,184,758
October	240	....	134,146	210,532,632	29,717	460 61	69,129,969
November......	315	....	172,488	276,700,968	41,348	640 89	64,741,120
December	72	....	39,050	62,792,400	8,560	132 68	67,904,220
Total..	5,241	05	2,830,329	3,655,010,124	497,557	$7,864 93	....

ENGINE No. 3.

January	288	....	149,205	268,569,000	35,728	$561 06	71,469,061
February	......	....	....	....	....	....	....
March..........	264	....	146,320	263,376,000	34,764	559 70	72,662,500
April	720	....	407,546	733,582,800	97,800	1,574 57	71,940,619
May	96	....	52,166	93,898,800	11,304	181 99	79,669,443
June	600	....	345,461	621,829,800	82,437	1,327 23	74,233,067
July............	431	20	255,570	460,026,000	61,696	975 09	74,001,135
August.........	721	40	435,891	784,603,800	111,542	1,728 90	70,397,830
September	552	....	310,145	558,261,000	78,275	1,213 26	70,187,903
October........	432	....	235,926	424,666,800	59,945	929 15	69,126,928
November	312	....	167,605	301,689,000	45,086	698 83	64,735,395
December	......	....	....	....	....	....	....
Total........	4,417	....	2,505,835	4,510,503,000	618,577	$9,749 78	....

ENGINE No. 4.

MONTHS.	Time run.		Revolutions.	Gallons Water	Gallons of Oil.	Cost of Oil.	Duty.
	H.	M.					
January							
February							
March	312		243,432	191,094,120	25,223	$406 10	
April							
May	648		580,029	455,322,765	54,828	882 73	
June	118	20	108,756	85,373,460	11,318	182 22	
July	261	45	275,377	216,170,945	28,988	458 16	
August							
September	168		162,362	127,454,170	17,870	276 98	
October	72		71,920	56,457,200	7,967	123 49	
November	91	45	88,040	69,111,400	10,328	160 08	
December	661	50	638,775	501,438,375	68,394	1,060 10	
Total	2,333	40	2,168,691	1,702,422,435	224,916	$3,549 86	
Aggregate	17,006	30	10,235,702	13,649,779,605	1,856,361	$29,283 47	

Fuel oil consumed	$29,283 47
Salaries, engineers and firemen	15,874 34
Consulting engineer	1,110 00
Coal for pumping oil	87 90
Printing and stationery	9 14
Material—rags, waste, polish, etc	315 93
Material—valves, gaskets, etc	346 49
Repairs, boilers and machinery	218 58
Lubricants	368 03
Horse farrier	3 50
Harness and repairs	6 65
Horse feed, shoeing, etc	33 83
Street car tickets:	11 50
Expenses on electric light	50 99
Insurance	400 00
Car rental	4 00
Ice	21 76
	$48,146 11

Cost per million gallons, $3.52. Nos. 1 and 2 Engines were run a good part of the year with pumps single acting.

The tables show that the water pumped during the year is 13,649,779,605 gallons. The total expense for pumping water is $29,283.47, making the cost per million gallons, $3.52. It will be noticed that the duty has fallen some, but this is accounted for by the additions to the heating and lighting plants, the steam for which is taken from the old boilers and hence affects the figured duty for engines Nos. 1, 2 and 3, and because during the past year we have only credited the engines with the work actually performed.

Our pressure has been carried higher at this station this last year than previously, and every foot in hight adds to the cost.

In connection with our lighting plant, I will say that it is being over-loaded. If the city lights could be used to light the grounds, we would be able to save additional expense in the lighting department. Our dynamos are one hundred light machines, and are now loaded to one hundred and twenty lights.

Crude oil as fuel is clean and convenient, but like other fuels it varies in quality, and I am satisfied has not the heating qualities as formerly; also, it is not convenient to measure. It is supposed to be sold at 60 degrees Fahr., and for every change of 25 degrees 1 per cent. added or deducted, as the case may require. It will readily be seen that if metered, we would be troubled with the same difficulty, but with gases collecting in the meter added.

The arrangements which I recommended in my last report, so as to convert our pumps from double to single acting without stopping, was completed and tested May 13th, and proved to be a great improvement, which has been needed ever since the reservoir has been discontinued. We not only save water by its use, but it does not leave the engines disabled as formerly, saying nothing of the convenience; but to complete its efficiency, I have recommended changing the Stevens cut-off for that of the Sickles, which I expect will be finished about the 10th of February. We would then be able to cut off at the point desired when working our pumps single acting, and would then get the benefit of the expansion of the steam, which means the saving in fuel.

Engines Nos. 1, 2 and 3 are in fair condition, although but minor repairs have been done to them this last year.

Since removing weight from fly-wheel of No. 1 engine, and balancing by placing weight in piston instead, the engine runs much smoother.

The boilers are in fair condition, considering their age; but minor repairs have been made to them the past year. The boilers in the west room have been in service eighteen years. I would like to have them replaced with some of the latest improved. That would give us a higher pressure of steam, which I consider would be an improvement, for the pressure that has been carried has always been too low for a compound engine.

Previous to this fall and winter, we have been troubled with weeds and ice on our river strainers. I conferred with Mr. Kirby, and suggested taking every other slat out of face of strainer, which was done last summer, and I am satisfied it will be a great benefit. Instead of being blocked out in the river as formerly, we may be blocked at our inland strainers; if so, we can readily clear them.

In my last report it was recommended to discontinue the stand pipe, by placing additional relief gates on the pipes. I think it would be perfectly safe to shut it off, with what relief we now have on our engines, but, certainly, the higher the pressure added each year, the greater will be the strain on our pumps and connections. I consider, however, the stand pipe is not effective for the purpose of taking the pulsation off the pumps, or a guard against a water ram. Heavy bodies move slowly. That being the case, it is certainly no use for either purpose. The cause of the water ram or hammer which has been mentioned in former reports is not quite clear to me, for not having any valves or gates of sufficient size that could be closed quickly, I can see but one way to account for it, which is by air collecting in the pipes at some high part of the system.

The continuous running of our new triple expansion engine has been considerably interfered with by defects in the suction conduit, but the necessary alterations have now been made and no further trouble is anticipated. The engine has been run intermittantly for some time, but not at its full capacity long enough to show conclusively what duty it will perform. In consequence, I have left duty space in table blank, but feel satisfied that it will come up to expectations. The official test we expect will be made some time in the beginning of the new year.

The new tile roof which was put on the engine house last fall is a decided improvement on slate, as it readily absorbs the condensation, which the slate would not do. The building is also warmer.

Respectfully submitted.

URIAH GOULD,
Engineer.

REPORT OF THE SUPERINTENDENT OF GROUNDS.

To the Honorable Board of Water Commissioners:

GENTLEMEN—In submitting my report for the year, I beg leave to say your predecessors certainly made no mistake in acquiring this splendid site for the City Water Works. The improvements under your direction and the gentlemen who have preceded you, must be a source of gratification to you and the citizens of Detroit.

Facts and figures show it to be a pumping station that for efficiency and beauty is equalled by few and excelled by none.

The surrounding Park is rapidly coming into a high state of cultivation, and the multitudes who visit it testify that as a place of rest and recreation, it is one of which the citizens of Detroit may justly feel proud.

Of the improvements completed this season, the Hurlbut Memorial Gateway notably is a thing of beauty and grandeur that will perpetuate the name of Chauncey Hurlbut for hundreds of years.

The winding canal dredged from the river through what was previously a low marsh, has greatly improved this part of the grounds. The leveling and planting of trees and shrubs make this a valuable addition to the Park. It will, however, be two or three years before the ground will be firmly settled and covered with good sod. Of the two islands the larger has been planted with trees and shrubs, while the smaller one will be kept for flowers.

Another of this year's improvements is our water pipe system for sprinkling purposes, which is now complete.

There are a few needed improvements which I hope you will order the coming year, *i. e.*, a ladies' toilet room and a shelter for horses. I have mentioned these in former reports, but as they are so much needed, I take the liberty of calling your attention to them again. Within a year or so we should have some good substantial bridges across the winding canal—one team and two foot bridges. The temporary bridges will answer for the present.

I understand the Superintendent and Secretary has already recommended the removal of the old dock and the fence around the basin. The dock is fast going to decay and is an eyesore. I hope you will order it removed soon, as we have no use for it other than an earth embankment between the basin and the canal. The fence was erected probably to keep animals from the water, but as no animals are allowed to run at large in the Park now, it has become useless, and that part of the Park will be very much improved by having it removed.

The lighting of the grounds is hardly satisfactory, as the recent addition to the engine house and the new engine require all the light the dynamos are able to furnish. I would be pleased to have the outside lighting done by the public lighting plant.

Our greenhouse stock is in splendid condition. Although we are in need of more room, we hope by skillful management to make a floral display equal to any in the country next season.

With this I enclose invoice of movable property in this Department.

Respectfully submitted.

E. A. SCRIBNER,
Superintendent of Grounds.

REPORT OF THE SUPERINTENDENT OF EXTENSIONS.

DETROIT, MICH., January 2d, 1895.

To the General Superintendent and Secretary:

DEAR SIR—In accordance with the regulations of the Board of Water Commissioners, I have the honor of presenting to you my Annual Report, relative to the general condition and progress of the work in this Department.

The records of the year just closed reveal the fact that not less than 39 miles of extensions have been added to our pipeage.

The work of the year has been one of ceaseless activity, there having been but little cessation in the work of extensions during each month of the year, the average having been about 3.25 miles per month.

It may be seen by the records of this office that the greater number of lines laid have been for the replacing of wood and smaller lines of iron pipe, and otherwise improving the pipeage system. There is now but 950 feet of the log pipe left in use, and this is only temporarily left in. The coming season will no doubt see the closing up of this system. Seven hundred and twenty-five feet of this log pipe will be found in the abandoned section of Holden avenue, between Second and Third avenues; the other 225 feet is also in a vacated alley north of Grand River avenue, from west line of Lincoln avenue to alley west, left in to cure a dead end.

While it may be in order to congratulate ourselves that the old log-pipe system is now so near its extinction, we can not but remember how great a part it has played in the extension of the borders of this our beautiful city, though meager in its supply.

The laying of the pipe for the past year has been very generally distributed through the city, with the view of strengthening some of the weak points. I am pleased to know that many of these lines, as appearing in the records of our work of the past year, are among the recommendations of 1891, 1892 and 1893. Not a few of the larger lines were laid in the more central portions of the city, as well as in adjacent sections. Two rather lengthy lines were laid, extending beyond the city limits. One of 6- and 8-inch pipe was laid along Jefferson avenue to the new Driving Park, and the other, a 6-inch pipe, in line of Mt Elliott avenue, to the Forest Lawn Cemetery.

The principal lines appear in the following list of lines laid, as per size of pipe and locations: A line of 16-inch was laid in the upper section of the city, through Farnsworth street and Kirby avenue. This line takes its supply from the upper 42-inch main in Canfield avenue, running northerly in Dubois street to Farnsworth street, and thence westerly in Farnsworth street to Rivard street, and from this point northerly to Kirby avenue, and in Kirby avenue from Rivard street to Cass avenue, all intersecting lines of pipe connecting thereto. From the westerly end of this main, a line of 10- and 12-inch pipe was laid in Cass avenue, the 12-inch being a short section, running from Kirby avenue south on the east, to Kirby avenue north on the west, distance about 150 feet. On Cass avenue, a line of 10-inch pipe was laid from Kirby avenue south to Warren avenue, and from Kirby avenue north to Holden avenue. From this line on Cass avenue, two lines of 10-inch and one of 8-inch were laid in a westerly direction, the one in Holden and Bratshaw avenues running from Cass to Fourth avenues, thence from this point in Fourth avenue to Holden avenue, and from this point at Fourth avenue a line of 8-inch pipe was laid to the North Boulevard. The second line of 10-inch pipe was laid in Kirby avenue, from Cass to Trumbull avenues, and from which an 8-inch pipe was laid in Kirby avenue to Twelfth street. The 8-inch line was laid in Warren avenue, from Cass to Third avenues. Two lines of 12-inch main were laid in the central portion of the city, one of which was in Monroe avenue, from the 24-inch main in Cadillac Square, connecting with the same, and running north to Randolph street. The other line of 12-inch main takes a zig-zag course, connecting with the 30-inch main in Mullett street at Hastings street, thence running north in Hastings street to Catherine street, and westerly in Catherine street to the intersection of Gratiot avenue and St. Antoine street, connecting with the 6- and 10-inch pipe in Gratiot avenue. From this point the line takes a northerly direction in St. Antoine street to Elizabeth street, and in this street westerly to Beaubien street. From this point it again runs northerly in Beaubien street to Adelaide street, and in Adelaide street from Beaubien street to Brush street. From this point the line was reduced to 10-inches, the line running northerly from this point to Edmund Place connecting with the 24-inch main at this point. In addition to the above, 10-inch pipe was laid in Baldwin avenue, from Waterloo street to Gratiot avenue; Hamilton Boulevard, from Blaine avenue to Hazelwood avenue; Oakland avenue, from Belmont avenue to Harmon avenue, and from the North Boulevard to Horton avenue; also from Hamlin avenue to Marston Court.

The 8-inch pipe covers a distance of over 7 miles. Some of the lines were in consecutive order as follows: Beaubien street, running north from the 30-inch main in Gratiot avenue to Madison avenue, and from this point westward in Madison avenue to Brush street; thence north in Brush street to Elizabeth street, and westward in Elizabeth street to Park street. Benton street, from Beaubien street to Brush street; thence north in Brush street to Rowena street; westward in Rowena street to John R Street, and northward in John R street to Brady street. A line of 8-inch was laid in Adelaide street, from Brush street to Woodward avenue, and in High street, from Brush street to Woodward avenue. A line of 8-inch was also laid in consecutive order as follows: Brady street, from the 10-inch main in Beaubien street to Brush street; thence north in Brush street to Alexandrine avenue, and from which a line of 6-inch pipe was laid in Alexandrine avenue to John R street. Eight-inch pipe was also laid in Columbia street from

Beaubien street to John R street, and in Bagley avenue from Park street to Grand River avenue; also in Rowland and Griswold streets, from Michigan avenue to Clifford street. This line connects with the 24-inch main in Michigan avenue, and the 30-inch in State street. A line of 8-inch was laid in Martin Pl., from John R street to Woodward avenue. Two sections of 8-inch pipe were laid in Twelfth street; the lower section was from River street to Lafayette avenue, the upper section from Howard street to Baker street, and from which a line of 6-inch was laid in Howard street, from Tenth street to Twelfth street. The 8-inch line will connect with the new 12-inch main to be laid in Porter street. An 8-inch line was laid in alley east of Woodward avenue, from end of pipe north of Gratiot avenue to John R street; also in Woodbridge street, from Woodward avenue to St. Antoine street; and from this point in said street a 6-inch pipe was laid to Orleans street. The following 8-inch lines were laid in the more easterly and westerly portions of the city: West side: in Clark avenue from Fort street to end of pipe south of Dix avenue. This is now a continuous line of 8-inch from River street to M. C. R. R., connecting with the 10-inch main in Dix avenue and the 8-inch in Fort street; Thirty-fourth street from Jackson street to Michigan avenue; Vinewood avenue, from Merrick avenue to Grand River avenue. East side: Trombly avenue, from Dubois street to St. Aubin avenue; Dubois street, from Piquette avenue to Trombly avenue; Hastings and Theodore streets to Warren avenue; Oakland avenue, from Englewood avenue to Harmon avenue; Indiana street, from Beaubien street to Russell street; Leland street, from Dequindre street to Russell street, and in Van Dyke avenue south of Worcester street. There has been over 25 miles of 6-inch pipe laid, covering over 300 locations and ranging in lengths from 5 to over 8,000 feet.

In addition to the lines above mentioned, ten connections have been made of 8- and 10-inch diameters, with the upper 42-inch main in Mack avenue. The following are the points of connections: Ellery, Meldrum, Beaufait, Canton, Sheridan, Townsend, Helen, Fisher, Belvidere, Rohns, Holcomb and

When this line of 42-inch main was laid, of the above-mentioned avenues were platted, a short distance north of Jefferson; the balance until a number of years later, otherwise, have been set at the street intersections. Such open at the time were provided with branches.

PIPEAGE

of distribution pipe and mains laid and re-laid, wood pipe discontinued during the past year, is as iron pipe laid and re-laid $39\frac{3065}{5280}$ miles, of which re-laid; $3\frac{2259}{5280}$ miles of wood and $8\frac{2503}{5280}$ miles of discontinued, making the net increase of the miles. This amount added to the measured and wood pipe connected with the works will length $483\frac{1288}{5280}$ miles, of which $483\frac{1033}{5280}$ miles are feet are wood pipe, which in detail is as follows:

Measured Length in Feet for 1893.	Added Length in Feet for 1894.	Discontinued Length in Feet for 1894.	Total Length in Feet for 1894.
103	....	....	103
45,127	80	....	45,207
715	....	....	715
49,337	....	....	49,337
84,813	....	....	84,813
461	....	....	461
87	....	....	87
36,777	8,460	....	45,237
8,444	3,675	....	12,119
114,509	14,075	....	128,584
219,795	38,641	....	258,436
917,408	135,019	3,974	1,048,453
831,348	5,810	36,058	801,100
76,302	2,166	5,211	73,257
2,820	....	....	2,820
2,388,046	[illegible]	45,243	2,550,729

When I was appointed Superintendent of Extensions and Repairs in the early season of 1877, I found the total pipeage of the city did not exceed 187½ miles, of which 94⅜ miles was of iron, and 92⅝ wood pipe. During the interval which has elapsed between the opening of the season of 1877 and the closing of 1894, the log pipe system has disappeared, less the 950 feet previously mentioned, while that of the iron pipe has increased over 500 per cent., making the total increase of the pipeage 258 per cent.

There were connected with the water mains 140 hydrants and 26 reservoirs, making the total number now in use 2,478 hydrants and 520 reservoirs.

TABLE OF PIPEAGE AS ARRANGED BY WARDS.

WARD.	4-In.	6-In.	8-In	10-In.	12-In.	16 In.	18-In.	20-In.	24-In.	30-In.	36-In.	42-In.	45-In.	2-In.	3-In.	Logs.	Lead	Totals.	Feet Discontinued.	Feet Added.
First	62,808	58,519	23,853	29,474	2,600	15,573	......	......	6,754	3,934	......	2,349	......	......	5,252	......	......	211,116	12,634	24,954
Second	49,177	43,351	9,224	19,771	564	8,198	......	......	5,913	4,184	......	......	......	......	2,204	......	......	142,586	4,844	10,523
Third	39,000	39,297	8,988	8,695	1,933	3,264	......	......	4,548	2,399	......	1,679	......	......	5,872	......	......	115,675	7,130	14,037
Fourth	62,960	56,079	6,848	4,325	......	3,556	......	......	5,323	3,253	......	......	......	......	6,287	725	......	149,356	4,744	13,660
Fifth	56,777	26,392	10,074	9,720	985	2,491	......	......	3,678	2,513	......	1,749	......	......	4,205	......	......	118,584	8,521	10,389
Sixth	49,035	37,567	13,498	5,944	1,650	1,565	......	......	5,483	2,533	......	......	......	......	5,222	225	......	122,722	4,164	7,867
Seventh	44,706	24,744	19,386	3,576	2,514	802	......	406	11,255	3,083	......	1,829	......	......	2,593	......	......	114,894	4,233	6,013
Eighth	48,439	56,807	21,600	161	42	......	......	......	8,277	2,153	......	......	......	......	7,966	......	175	145,620	3,612	12,166
Ninth	58,506	68,900	12,592	4,103	1,815	3,430	......	......	2,433	12,063	715	3,369	......	......	6,907	......	......	174,833	7,739	10,583
Tenth	81,658	81,416	18,612	6,971	......	......	......	......	10,967	2,443	......	......	......	......	4,246	......	......	206,313	......	1,846
Eleventh	56,687	56,477	5,149	3,626	......	......	......	......	1,463	......	......	3,479	......	......	6,597	......	16	133,494	5,515	6,115
Twelfth	28,920	72,413	17,876	3,951	16	140	87	55	7,003	2,593	......	......	......	......	3,204	......	......	136,258	259	6,059
Thirteenth	62,325	54,130	8,002	3,016	......	......	......	......	513	7,173	......	7,519	......	......	7,073	......	......	149,751	805	11,708
Fourteenth	33,223	95,489	22,562	5,241	......	2,685	......	......	11,203	1,013	......	......	......	......	3,119	......	160	174,695	214	15,432
Fifteenth	39,478	147,989	32,590	9,238	......	......	......	......	......	......	......	23,234	103	2,820	712	......	213	257,377	......	22,968
Sixteenth	23,916	104,235	18,848	10,772	......	3,533	......	......	......	......	......	......	......	......	1,718	......	......	163,022	......	15,539
Outside city limits,	3,485	24,648	7,734	......	......	......	......	......	......	......	......	......	......	......	80	......	......	35,947	......	18,137
Totals in Feet.	801,100	1,048,453	258,436	128,584	12,119	45,237	87	461	84,813	49,337	715	45,207	103	2,820	73,257	950	564	2,552,243	64,414	207,996

I am glad it has appeared wise to you to place the care of our water-gates, and the appurtenances thereto, in competent hands. The unskillful handling of this branch of the pipe system during the early part of last year, and the latter part of the previous year, has been the cause of endless annoyances. I am now looking forward, with special interest, to the abatement of the former annoyances. Mr. John Bridge, whom you have appointed Superintendent of this Department, with his practical mechanical abilities, should be sufficient guarantee that this branch of the works is in efficient hands.

Owing to the cause of some unforeseen changes in the office of this Department during the past year, it has in some measure complicated our work, which for a time has been a source of additional care. I trust, however, that the opening season, with our increased force of clerical help, under the efficient supervision of Mr. A. W. Goodsell, will be the means of a complete and satisfactory showing of this Department work.

TABLE OF NEW GATES SET FOR SHUT-OFFS.

No. of each kind.	NAME OF GATE.	SIZE.	REMARKS.
10	Murdock Valve Company..............	16-in.	Set for Shut-off.
7	" " "	12-in.	" "
34	" " "	10-in.	" "
73	" " "	8-in.	" "
380	" " "	6-in.	" "
1	" " "	6-in.	For Blow-off.
60	" " "	4-in.	Set for Shut-off.
1	" " "	3-in.	For Blow-off.
1	Michigan Brass and Iron Works........	10-in.	Set for Shut-off.
8	" " "	8-in.	" "
51	" " "	6-in	" "
11	" " "	4-in.	" "
637	Total.		

TABLE OF OLD GATES RESET FOR SHUT AND BLOW-OFFS.

No. of each kind.	NAME OF GATE.	SIZE.	REMARKS.
1	Flowers Bros	6-in.	Reset Shut-off.
1	" "	4-in.	" "
5	" "	4-in.	Reset Blow-off.
2	" "	4-in.	Set Blow-off.
2	" "	3-in.	" "
6	Murdock Valve Company	6 in.	Reset Shut-off.
1	" " "	6-in.	Set Blow-off.
1	" " "	4-in.	Reset Shut-of.
22	" " "	4-in.	Set Blow-off.
10	" " "	4-in.	Reset Blow-off.
1	Galvin Bros	4-in.	Set Blow-off.
1	Pittsburgh	12-in.	" "
1	"	4-in.	Reset Blow-off.
1	Michigan Brass and Iron Works	6-in.	Reset Shut-off.
1	" " " "	4-in.	Set Blow-off.
56	Total.		

TABLE OF GATES TAKEN OUT.

No. of each kind.	NAME OF GATE.	SIZE.
1	Flowers Bros	6-in.
49	" "	4 in.
6	" "	3 in.
1	Eddy	6-in.
1	Murdock Valve Company	8 in.
7	" " "	6-in.
91	" " "	4-in.
1	" " "	3-in.
20	Pittsburgh	4-in.
26	Galvin Bros	4-in.
13	Ludlow	4-in.
3	Michigan Brass and Iron Works	6-in.
5	" " " "	4-in.
1	Scowden	10-in.
5	"	6 in.
1	"	4 in.
1	Prong	10 in.
232	Total.	

GATES IN SYSTEM TO JANUARY 1, 1895.

	42-In.	36-In.	30-In.	24-In.	20-In.	18-In.	16-In.	12-In.	10-In.	8-In.	6-In.	4-In.	3-In.	Total.	Per Cent.
Murdock	4	...	11	16	...	...	24	19	154	401	1,455	1,227	9	3,320	59.820
Flowers	20	...	10	18	...	...	...	...	39	52	244	447	22	852	15.352
Galvin Bros	...	1	7	12	...	...	21	...	12	32	171	276	1	533	9.603
Michigan Brass and Iron Works	...	...	...	...	10	...	7	5	22	25	352	98	...	519	9.352
Pittsburgh	...	...	...	13	...	2	1	1	9	11	31	133	...	201	3.622
Eddy	...	...	...	1	...	...	...	...	15	4	6	9	...	35	0.630
Scowden	...	...	...	...	...	...	...	...	3	3	....	....	...	6	0.108
Ludlow	...	...	...	...	...	...	...	...	1	3	11	13	...	28	0.504
Prong	...	...	...	...	...	...	...	...	....	....	1	....	...	1	0.018
Boston	...	...	...	...	...	...	...	...	....	1	1	....	...	2	0.036
Newport	...	...	...	...	...	...	...	...	....	....	....	1	...	1	0.018
No Name	...	...	...	...	...	...	...	...	....	3	9	39	1	52	0.937
Total	**24**	**1**	**28**	**60**	**10**	**2**	**53**	**25**	**255**	**535**	**2,281**	**2,243**	**33**	**5,550**	**100.000**

The last-mentioned table gives the total number of water-gates in the pipeage system, name of maker, number of each size, and percentage of each manufacture. The following table gives the length of 3-, 4- and 6-inch pipe and logs which have been replaced with pipe of larger size, in detail, as follows:

SIZE OF PIPE LAID.	SIZE OF PIPE AND LOGS REPLACED.	LENGTH OF PIPE LAID.
4-inch iron pipe.........	3-inch iron pipe.........	5 feet.
4 " " "	Log pipe............. ...	2,923 "
6 " " "	3-inch iron pipe.........	4,640 "
6 " " "	4 " " "	12,210 "
6 " " "	Log pipe...............	14,295 "
8 " " "	3-inch iron pipe.........	230 "
8 " " "	4 " " "	12,634 "
8 " " "	6 " " "	359 "
8 " " "	Log pipe...............	1,953 "
10 " " "	3-inch iron pipe.........	336 "
10 " " "	4 " " "	5,174 "
10 " " "	6 " " "	2,451 "
12 " " "	4 " " "	1,371 "
12 " " "	6 " " "	1,104 "
16 " " "	4 " " "	4,669 "
16 " " "	6 " " "	60 "
TOTAL..............	....	64,414 "

I take the liberty of drawing your attention to some statements which appeared in the last Annual Report, and which I think were unadvisably made, as the showing of the past year's work will forcibly reveal. I refer to the large percentages of the pipe-joints said to be found leaking. The past year's work of replacing eight and a half miles of pipe, more than seven-eighths of which was exposed and also taken out, failed to develop five per cent. of such leaks, as well also the numerous service connections in this length of pipe. I think two per cent. would have been nearer correct. I simply make this statement in justice to myself, from the severe criticism which appear in a previous report.

The men whom I have employed as calkers are very efficient in this class of work, as well as pipe-fitters. Several of these men have had more than twenty years' experience, and have been that length of time in the employ of the works, and I believe their highest ambition is to know that their work is approved. I would also state that any intricate work, such as the cross-street intersections, and all such special work, is left exposed until tested.

REPAIR DEPARTMENT.

Owing to your readjustment of the different branches of the works, the supervision of the Repair Department will now appear with the Meter Department.

The work of this Department while under my care, with Mr. John Wallace as its chief foreman and his corps of faithful men, the numerous items of work falling to this department were efficiently met.

PUMPING WORKS.

Since the completion of the last connection of the 42-inch mains to the No. 4 Engine and the suction pipe, I have had but little work to do at this place.

It would be a breach of courtesy not to mention your kindness and forbearance of the many calls we have had to make upon your attention. I am pleased to say, that the co-operation with the Civil Engineering and the Meter and Repair Departments has been of a pleasant character.

Transmitted with this report are the locations of the pipeage of the city to January 2, 1895.

Respectfully submitted.

HENRY BRIDGE,
Superintendent of Extensions.

VALUATION OF THE WORKS.

AGGREGATES.

Real estate	$413,427 29
Oil plant	14,649 29
Buildings, docks, basins, conduits, force mains at pumping works	853.602 69
Water pipe laid and in use	3.356,355 65
Meters placed and in use	85,687 03

TOOLS AND MATERIALS ON HAND.

Office furniture and fixtures	10,767 00
In Repair Department	542 15
In Meter Department	1,699 20
In Service Cocks Department	1,772 85
In Iron Pipe Department	25,222 69
In Pumping Water and Works Department	25,257 17
In Hurlbut Fund Department	555 48
Horses, vehicles and harness	5,969 00
Aggregate	$4,795,507 49

The above valuation consists in details as follows:

REAL ESTATE.

Office building and lot	$60,000 00	
Orleans street lots	33,750 00	
Storage grounds and improvements	48,200 00	
Pumping works grounds and improvements	271,477 29	
		$413,427 29

OIL PLANT.

Pumping station house, engines and pipes, tanks and fixtures at works	$14,649 29

PUMPING WORKS.

Buildings, dock, basin, conduits, pipe, etc.	$853,602 69
Tools	1,103 25
Materials: Rope, waste, etc.	928 78
Gauges, valves, etc.	815 85
Iron, lead, etc.	815 68
Furniture	300 00
Wood and coal	14,823 40

Fuel oil (155,661 gals.)	$2,412 74	
Hoisting engines, pony pumps and boilers, electric light plant and stock, gas machines, etc.	4,057 47	
Tools and materials—Hurlbut Fund	555 48	
		$879,415 84

OFFICE BUILDING.

Counter	in office	$1,000 00
Fourteen office tables	“ “	215 00
Six book cases	“ “	660 00
Three wardrobes	“ “	335 00
Nine desks	“ “	242 00
Thirty-six chairs	“ “	91 50
Thirteen office stools	“ “	40 00
Eight city maps	“ “	20 00
One marble clock	“ “	100 00
Four atlas maps	“ “	100 00
Partitions and railings	“ “	800 00
Heating apparatus	“ “	1,400 00
Electric light fixtures	“ “	85 00
Miscellaneous properties	“ “	100 00
Furniture in board room		575 00
4 stools	in engineering dep't	12 00
4 drafting tables	“ “ “	50 00
3 drafting tables and horses	“ “ “	26 00
2 drafting boards	“ “ “	2 00
1 blue print outfit	“ “ “	25 74
1 case instruments	“ “ “	60 00
2 rolls vellum	“ “ “	15 50
5 tee squares	“ “ “	6 25
1 roll oil cloth	“ “ “	2 00
2 straight edges	“ “ “	2 00
2 tape lines	“ “ “	2 25
2 readers	“ “ “	2 35
1 desk chair and stool	“ “ “	40 25
1 table	“ “ “	27 00
1 drafting table	“ “ “	15 00
5 chairs	“ “ “	15 00
Cases of maps, drawings and records	“	1,500 00
1 case for drawings	“ “ “	80 00
Maps and drawings	“ “ “	2,500 00
Instruments	“ “ “	330 00
Clock	“ “ “	12 00
1 safe and hat rack	“ “ “	28 50
1 case for filing reports	“ “ “	25 00
1 wash stand	Sup't of Ex. room	26 66
5 desks	“ “ “ “	100 00
1 table	“ “ “ “	4 50

10 chairs	Sup't of Ex. room..	$23 00	
2 pigeon hole cases	" " " " ..	3 00	
1 copy press book and stand	" " " " ..	10 00	
Ink and inkwells	" " " " ..	7 50	
Blanks, stationery, etc.	" " " " ..	50 00	
			$10,767 00

REPAIR DEPARTMENT.

2	sleighs	$25 00
2	sets runners	20 00
4	horse blankets (old)	4 00
2	sets calking tools	1 50
328	lbs. pig lead	9 84
819	lbs. scrap lead	24 57
35	lbs. sheet lead	1 50
205	lbs. wiping solder	1 00
35	lbs. strap solder	1 00
180	lbs. 1½ in. lead pipe	9 40
35	lbs. 1 in. lead pipe	1 75
70	lbs. ⅝ in. lead pipe	3 50
8	ladles	12 00
2	plumbers' fire pots	10 00
12	diamond point chisels	12 00
12	flat chisels	6 00
1	anvil	2 50
2	vises	8 00
29	gate keys	35 00
14	street keys	14 00
2	pumps	37 40
15	hydrant wrenches	5 50
8	dippers	4 00
4	pairs rubber boots	12 00
2	leather coats	8 00
18	shovels	11 70
8	picks	8 00
5	pounders	5 00
4	pounder handles	80
19	lanterns and 20 red globes	19 00
2	saws	1 25
1	draw knife	50
1	rope ladder	1 00
1	log rimmer	1 75
1	platform scales	25 00
2	force pumps	8 00
1	grindstone	1 25
10	water pails	2 00
70	ft. ⅝ in. hose	5 00

1 sledge	$1 00	
1 8-in. bolted sleeve	3 15	
1 6-in. bolted sleeve	2 00	
14 4-in. bolted sleeves	15 75	
3 3-in. bolted sleeves	82	
3 3-in. plain sleeves	1 75	
4 4-in. plain sleeves	2 25	
1 8-in. plain sleeve	1 76	
1 4-in. curve	1 16	
1 3-in. bend	90	
3 6-in. Flowers gate stems	5 25	
3 4-in. Flowers gate stems	5 25	
4 6-in. Mich. Brass & Iron Works stems	9 60	
4 4-in. Mich. Brass & Iron Works stems	7 00	
5 4-in. Murdock gate stems	8 75	
3 4-in. Murdock gates	18 00	
1 6-in. Murdock gate	9 00	
3 4-in. Flowers' gates	18 00	
5 4-in. stuffing boxes, M. B	3 75	
6 8-in. stuffing boxes, M B	6 00	
6 6-in. stuffing boxes, M. B	4 80	
3 4-in. Murdock gate stuffing boxes	2 25	
3 prong keys	3 00	
3 crowbars	2 75	
1 machine for raising gate boxes	3 00	
2 axe handles	50	
2 axes	2 00	
2 4-in. caps for iron pipe	1 00	
2 gate boxes	6 00	
6 rubber discs for pumps, No. 1	18 00	
6 rubber discs for pumps, No. 2	18 00	
		$542 15

SERVICE COCKS.

1 Smith tapping machine	$850 00
1 2x4 Smith sleeve and valve	9 00
1 3x4 " " " "	10 00
1 4x4 " " " "	13 00
1 2x6 " " " "	11 50
1 3x6 " " " "	12 50
1 4x6 " " " "	16 00
1 2x8 " " " "	12 00
2 3x8 " " " "	28 00
1 4x8 " " " "	18 00
1 6x8 " " " "	23 00
1 2x10 " " " "	16 00
1 3x10 " " " "	18 00
1 4x10 " " " "	22 00

3 Mueller tapping machines		$255 00	
1 30-in. saddle		1 00	
2 24-in. “		2 00	
2 16-in. “		2 00	
2 12-in. “		2 00	
3 10-in. “		3 00	
3 8-in. “		3 00	
3 6-in. “		3 00	
3 4-in. “		3 00	
3 3-in. “		3 00	
5 yokes		5 00	
3 pressure wrenches		1 50	
3 handles for turning taps		50	
8 1-in drills and taps	at $3 00	24 00	
8 ⅝-in. “ “ “	“ 2 00	16 00	
2 ¾-in. “ “ “	now 4 00	8 00	
2 ¾-in. taps	“ 1 50	3 00	
2 ½-in. drills and taps	“ 1 75	3 50	
215 1-in. service cocks	“ 90	193 50	
63 ⅝-in. “ “	“ 45	28 35	
1 emery wheel and spindle		2 00	
5 oil cans		1 00	
2 pairs rubber boots		8 00	
2 horse blankets		9 00	
5 monkey wrenches		3 75	
2 leather jackets		5 00	
1 Stilson wrench		75	
8 blankets		24 00	
8 robes		24 00	
8 picks		4 00	
8 spades		6 00	
8 street keys		12 00	
6 rubber covers for horses		12 00	
8 rubber aprons for buggies		12 00	
8 tape lines		6 00	
8 pipe gauges		24 00	
			$1,772 85

METER DEPARTMENT.

Meters placed and in use		$85,687 03
1 foot lathe	$90 00	
1 chuck (Cushman)	6 00	
1 chuck (drill)	3 00	
Drills, tools and taps	3 50	
1 lathe clamp	1 12	
1 screw chaser	25	
1 plug	90	

1	1-inch stock and dies		$30 00
1	2-inch stock and dies		
1	ratchet, stock and dies.		
1	1-inch pipe cutter		
1	2-inch pipe cutter		
1	2-inch and 1 3-inch cutter—2-inch $5.00, 3-inch $12.00		17 00
1	6-inch cutter		15 00
28	cutter wheels	at 25 cts.	7 00
1	6-inch monkey wrench		50
1	12-inch monkey wrench		75
1	8-inch monkey wrench (Westcott)		75
1	8-inch pipe wrench (Westcott)		75
1	12-inch pipe trim wrench		75
2	18-inch monkey wrenches	at $2 50	5 00
2	pairs No. 3 chain tongs	at 6 00	12 00
3	pairs gas tongs	at 50 cts.	1 50
1	⅛-inch gas tap		37
1	¼-inch gas tap		42
1	2-inch gas tap		2 50
4	small ladles for fire pots	at 25 cts.	1 00
2	ladles for making calk joints	at 75 cts.	1 50
4	fire pots	at $5 00	20 00
5	hand pumps	at $2 00	10 00
2	sets calking tools	at 30 cts.	60
1	calking hammer		3 00
1	pair snips		2 50
8	hand lanterns	at 30 cts.	2 40
1	4-inch gate key		4 00
1	long gate key and 4 short gate keys		5 50
2	pair hip boots (old)		2 00
1	chain fall		10 00
1	electric lamp		10 00
1	bench vise		3 00
1	breast drill		2 50
1	pipe vise		10 00
1	washer cutter		50
6	hand saws	at $1 25	7 50
2	broad axes	" 1 00	2 00
1	watch tackle and rope		3 00
2	hollow punches		1 50
2	screw drivers		40
2	crow foot wrenches		1 00
2	cold chisels		60
1	5-gal. gasoline can		25
8	combination meter box wrenches	at $2 00	16 00
1	extension bitt		2 50
1	jack plane		50

1-in. woodchisel	$0 50	
1 hydrant wrench	50	
1-2 ft. try square	1 00	
1 saw set	75	
1 water motor	50 00	
1 claw hammer	50	
1 bailing dipper	1 00	
1 sun shade for wagon	2 00	
Blankets and robe	8 00	
Rubber cover	1 00	
89 iron couplings	4 85	
77 unions	12 10	
88 elbows	6 14	
68 street elbows	5 69	
71 angle elbows	9 80	
26 tees	2 50	
168 iron nipples	9 58	
98 bushings	6 20	
185 reducers and odd fittings	16 27	
9 meter box covers	19 60	
8 2-in. sleeves	2 86	
8 4-in. sleeves	3 27	
11 2-in expansion joints	3 77	
4 3-in expansion joints	2 45	
1 4-in. expansion joint	98	
14 pipe flanges	1 70	
Wire spikes	35	
8d nails	37	
Wiping solder	6 84	
Block tin	1 63	
Lead pipe	11 56	
1 bag cement	60	
11 check valves (Rouse)	12 06	
5 inside stop cocks	3 74	
84 solder nipples	3 90	
69 meter couplings	29 84	
50 meters	990 00	
5 registers, bolts, discs, etc	78 90	
Lumber	13 60	
2 bicycles	50 00	
		$1,699 20

IRON PIPE DEPARTMENT.

PIPE IN GROUND.

103	feet	45-in.	pipe	$1,699 50
45,207	"	42	"	660,196 40
715	"	36	"	6,587 35

49,337	feet	30-in.	pipe	$322,404 86	
84,813	"	24	"	403,704 93	
461	"	20	"	1,751 80	
87	"	18	"	278 40	
45,237	"	16	"	140,163 78	
13,119	"	12	"	24,898 63	
128,584	"	10	"	199,773 41	
258,436	"	8	"	300,302 07	
1,048,453	"	6	"	751,384 22	
801,100	"	4	"	506,484 78	
73,257	"	3	"	35,973 42	
2,820	"	2	"	752 10	
					$3,856,855 65
2,550,729	total feet.				

STOCK AT RESERVOIR.

Iron pipe	$8,197 67	
Specials	7,270 17	
Gates and valves	3,467 32	
Gate boxes	111 60	
Gate well covers	39 46	
Lead	3,296 11	
Packing	8 55	
Oil	1 30	
Coal	4 40	
Scrap iron	45 00	
Tools	2,398 86	
Covers and blankets for horses	35 00	
Material, lumber, cement, etc	347 25	
		$25,222 69

HORSES AND WAGONS.

1 horse, phaeton, sleigh and harness—Office	$305 00	
1 horse, cart, etc., and harness—Pumping Works	125 00	
2 horses, 1 wagon, 1 carriage, etc.—Meter	392 00	
4 horses, 4 wagons and harness—Repairing Leaks	600 00	
2 horses, 2 wagons and harness, etc.—Service Cocks	478 00	
6 buggies, 6 carts, 6 sets of harness—Service Cocks	810 00	
11 horses, 11 wagons, 4 buggies and 11 harness—Iron Pipe	3,071 00	
1 horse, 1 cart and harness—Hurlbut Fund	188 00	
		$5,969 00
Aggregate		$4,795,507 49

SUPPLEMENT.

BOARD OF MANAGEMENT OF DETROIT WATER WORKS.

Board of Trustees appointed by Common Council, February 24th, 1852; organized March 1st, 1852.

Shubael Conant, Chairman. Edmund A. Brush.
Henry Ledyard. Jas. A. Van Dyke.
Wm. R. Noyes.

1853.

On the 16th of May, 1853, the Board of Water Commissioners of the City of Detroit was organized under an act previously approved by the Common Council and passed by the Legislature, February 14th, 1853. The term of service was determined by lot, as follows:

Jas. A. Van Dyke,	for 3 years.
Edmund A. Brush,	for 4 years.
Henry Ledyard,	for 5 years.
Shubael Conant,	for 6 years.
Wm. R. Noyes,	for 7 years.

Shubael Conant was elected President, who, finding the duties too arduous, resigned July 30th, and Edmund A. Brush was elected.

1854.

Edmund A. Brush, President. Jas. A. Van Dyke.
Shubael Conant. Wm. R. Noyes.
Henry Ledyard.

1855.

Edmund A. Brush, President.
Henry Ledyard.
Shubael Conant.
Wm. R. Noyes.
Jas. A. Van Dyke, died May 8th.
A. D. Fraser, appointed to fill vacancy.

1856.

Edmund A. Brush, President.
Shubael Conant.
Wm. R. Noyes.
Alexander D. Fraser, re-appointed May 1st, for 5 years.
Henry Ledyard.

1857.

Edmund A. Brush, President, re-appointed May 1st, for 5 years.
Henry Ledyard.
Alexander D. Fraser.
Wm. R. Noyes.
Shubael Conant.

1858.

Edmund A. Brush, President.
Shubael Conant.
Alexander D. Fraser.
Henry Ledyard, re-appointed May 1st, for 5 years.
Wm. R. Noyes.

1859.

Edmund A. Brush, President.
Alexander D. Fraser.
Wm. R. Noyes.
Shubael Conant, term expired May 1st, and
Julius D. Morton, appointed for 5 years.
Henry Ledyard, vacated by removal from city, and
Jno. V. Ruehle, appointed May 1st to fill vacancy.

1860.

Edmund A. Brush, President.
Alexander D. Fraser.
Julius D. Morton.
Wm. R. Noyes, re-appointed May 1st, for 5 years.
Jno. V. Ruehle.

1861.

Edmund A. Brush, President.
Alexander D. Fraser, re-appointed May 1st, for 5 years.
Jno. V. Ruehle, resigned Sept. 16th, and
Chauncey Hurlbut, appointed to fill vacancy.

1862.

Edmund A. Brush, President. re-appointed May 1st, for 5 years.
Wm. R. Noyes.
Julius D. Morton.
Chauncey Hurlbut.
Alexander D. Fraser.

1863.

Edmund A. Brush, President.
Alexander D. Fraser.
Wm. R. Noyes.
Julius D. Morton.
Chauncey Hurlbut, term expired May 1st, and
Stanley G. Wight, appointed for 5 years.

1864.

Edmund A. Brush, President.
Alexander D. Fraser.
Wm. R. Noyes.
Julius D. Morton, term expired May 1st.
Stanley G. Wight.

1865.

Edmund A. Brush, President.
Wm. R. Noyes, resigned Jan. 10, and Jacob S. Farrand appointed to fill vacancy. Term expired May 1st. Re-appointed for 5 years.
Alexander D. Fraser.
Stanley G. Wight.
Julius D. Morton, re-appointed for 5 years from May 1st, 1864. Died Feb. 14, 1865, and
Jno. Owen, appointed to fill vacancy.

1866.

Edmund A. Brush, President.
Alexander D. Fraser, re-appointed May 1, for 5 years.
Stanley G. Wight.
Jacob S. Farrand.
Jno. Owen.

1867.

Edmund A. Brush, President, re-appointed May 1, for 5 yrs.
Alexander D. Fraser.
Jacob S. Farrand.
Jno. Owen.
Stanley G. Wight.

1868.

*Edmund A. Brush, President.
Stanley G. Wight, term expired May 1, and
Chauncey Hurlbut appointed for 5 years.
Jacob S. Farrand.
John Owen.
Caleb Van Husan.

***Edmund A. Brush resigned January 28, and Caleb Van Husan appointed to fill vacancy, and Alexander D. Fraser elected President.**

1869.

Alexander D. Fraser, President.
Jno. Owen, re-appointed May 1, for 5 years.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.

1870.

Alexander D. Fraser, President.
Jacob S. Farrand, re-appointed May 1, for 5 years.
Jno. Owen.
Caleb Van Husan.
Chauncey Hurlbut.

1871.

*Alexander D. Fraser, President.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.
John Owen.

***Term expired May 1, and Samuel F. Hodge appointed for 5 years. Jacob S. Farrand elected President.**

1872.

Jacob S. Farrand, President.
Jno. Owen.
*Caleb Van Husan.
Samuel F. Hodge.
Chauncey Hurlbut.

*Term expired May 1st, and Elija Smith appointed for 5 years.

1873.

*Chauncey Hurlbut, President.
Jno. Owen.
Jacob S. Farrand.
Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed. Elected President, May, 1872.

1874.

Chauncey Hurlbut, President.
*Jno. Owen.
Jacob S. Farrand.
Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1875.

Chauncey Hurlbut, President.
Jno. Owen.
*Jacob S. Farrand.
Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1876.

Chauncey Hurlbut, President.
Jno. Owen.
Jacob S. Farrand.
*Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1877.

Chauncey Hurlbut, President.
Jno. Owen.
Jacob S. Farrand.
Samuel F. Hodge.
*Michael Martz.

*Elija Smith's term expired and Michael Martz appointed to fill vacancy.

1878.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Michael Martz.

*Term expired and re-appointed.

1879.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
*Jno. Pridgeon.

*Jno. Owen's term expired and Jno. Pridgeon appointed to fill vacancy. Samuel F. Hodge resigned and Jas. Beatty appointed to fill vacancy.

1880.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1881.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1882.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1883.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1884.

Chauncey Hurlbut, President.
Michael Martz.
Jacob S. Farrand.
Jas. Beatty.
*Jno. Pridgeon.

* Term expired; Marshall H. Godfrey appointed.

1885.

*Jacob S. Farrand, President.
Marshall H. Godfrey.
Michael Martz.
*Edwin F. Conely.
*Samuel G. Caskey.

* Jas. Beatty died and Edwin F. Conely appointed to fill vacancy.
* Chauncey Hurlbut died and Samuel G. Caskey appointed to fill vacancy.
* Jacob S. Farrand's term expired and re-appointed.

1886.

Jacob S. Farrand, President.
Marshall H. Godfrey.
Michael Martz.
*Jno. Pridgeon.
Samuel G. Caskey.

* Edwin F. Conely's term expired and Jno. Pridgeon appointed to fill vacancy

1887.

Jacob S. Farrand, President.
Marshall H. Godfrey.
Jno. Pridgeon.
Samuel G. Caskey.
*Joseph Nagel.

* Michael Martz's term expired and Joseph Nagel appointed to fill vacancy.

1888.

Jacob S. Farrand, President.
Marshall H. Godfrey.
Jno. Pridgeon.
*Samuel G. Caskey.
Joseph Nagel.

* Term expired and re-appointed.

1889.

Jacob S. Farrand, President.
Samuel G. Caskey.
Jno. Pridgeon.
Jos. Nagel.
*August Goebel.

* Marshall H. Godfrey resigned January 1, 1889. August Goebel appointed to fill vacancy. Term expired May 1st, and re-appointed.

1890.

Jno. Pridgeon, President. Samuel G. Caskey.
Joseph Nagel. August Goebel.
*Henry M. Duffield.

* Jacob S. Farrand's term expired, and Col. Duffield was appointed to fill vacancy. July 9th, 1890; Jno. Pridgeon resigned as President of the Board, on account of ill-health, and Henry M. Duffield was elected to fill vacancy.

1891.

Henry M. Duffield, President. *Jno. Pridgeon.
August Goebel. Samuel G. Caskey.
Joseph L. Hudson.

* Jno. Pridgeon's term expired May 1st, and Frank E. Kirby was appointed for a term of 5 years.

1892.

Samuel G. Caskey, President. Henry M. Duffield.
August Goebel. Joseph L. Hudson.
Frank E. Kirby.

1893.

August Goebel, President. Samuel G. Caskey.
Frank E. Kirby. Henry M. Duffield.
Joseph L. Hudson.

1894.

Henry M. Duffield, President. Frank E. Kirby.
Albert L. Stephens. De Witt H. Moreland.
Edward W. Pendleton.

CHANGES IN STREET NAMES, AND THEIR LOCATION.

PRESENT NAME.	FORMER NAME.	LOCATION.
Avery ave	Morley st	N. from Lothrop.
Bancroft ave	Williams ave. and Joy road	W. from Woodward.
Barker ave	Ferry ave	E. from McClellan.
Barry st	Willis ave	E. from McClellan.
Beals ave	Thorburn st	S. from Mack.
Beaman st	Sherman st	W. from Crane.
Belvidere ave	Company and Bolde aves	E. from McClellan.
Bingham st	Forest ave	E. from Cadillac.
Blair st	Palmer ave	E. from McClellan.
Bradley st	Mullett st	W. from Crane.
Brock st	Lincoln ave	N. from Lothrop.
Bruce st	Champlain st	W. from Crane.
Buhl st	Canfield ave	E. from Holcomb.
Burlingame ave	Englewood ave	W. from Woodward.
Cadillac ave	Cadillac boulevard	N. from Jefferson.
Calumet ave	Brigham st	W. from Third ave.
Canton ave	Godfrey ave	N. from Centerline rd.
Carlton st	Forest ave	E. from McClellan.
Carver st	Commonwealth ave	N. from Lothrop.
Chapin st	Hendrie and Medbury	E. from Fisher ave.
Clay ave	Pallister ave	E. from Woodward.
Conger st	Piquette ave	E. from Baldwin.
Cook st	Poplar st	E. from Welch ave.
Crane ave	Laclede ave	N. from Mack ave.
Crary st	Clinton ave	W. from Crane ave.
Cresswell st	Kirby ave	E. from McClellan.
Dallas st	Morton st	E. from Riopelle.
Deming st	Gilbert st	E. from Scotten.
Dillon ave	Lincoln ave	N. from Holden.
Douglas st	Warren ave	E. from McClellan.
Duncan st	Milwaukee ave	E. from Helen.
Durand st	Maple st	E.&W. from Van Dyke
Eldred st	Chandler st	W. from Junction.
Emmons st	Julia H. st	E. from McClellan.
Erskine st	Calhoun st	W. from Gratiot.
Farnsworth ave	Farnsworth st	Bet. Woodward and Mt. Elliott.
Fairbanks st	Lafayette place	E. from Scotten.
Felch st	Piquette	E. from McClellan.
Ferry ave	Kirby ave	E. from Baldwin.
Finley st	Custer ave	W. from Jos.Campau.
Fisher ave	Jane and Richard ave	N. from Mack.
Forest ave	Garfield ave	E. from McClellan.
Foster st	Beaufait ave	N. from Centerline rd.
Frederick ave	Fredrick st	Bet. Woodward and Mt. Elliott.
Gillet st	Blaine and Chandler	W. from St. Aubin.
Goodwin st	Hastings st	N. from Holbrook.
Gordon st	Warren ave	E. from Cadillac.
Goethe st	Elm Grove ave	W. from McClellan.
Granger st	Palmer ave	E from Baldwin.
Graves st	Hancock ave	E. from Holcomb.
Greeley st	Riopelle st	N. from Reutter.
Greenwood ave	Crawford st	S. from Boulevard.
Grummond ave	Cleveland ave	W. from Woodward.
Haigh ave	Bigelow and Andrus	W. from St. Aubin.
Hamilton boulevard	Crawford st	N. from Boulevard.
Harper ave	Centerline road and Buttler ave	N. City Line.
Hecla ave	Harrison ave	N. from Merrick ave.
Hendrie ave	Boulevard	E. from Baldwin.

PRESENT NAME.	FORMER NAME.	LOCATION.
Holcomb ave	Ackley ave	N from Gratiot.
Homer st	Agnes ave	W. from Crane.
Houghton st.	Charles J. st	E. from Holcomb.
Hyde st	Harper and Trombly aves	E. from Helen.
Kellogg st	Baltimore ave	E. from Baldwin.
Kirby st	Farnsworth st	E. from Baldwin.
Kitchell st	Riopelle st	N. from Pallister.
Laclede ave.	Parker ave	W. from Concord.
Ladue st	Trombly ave	E. from Baldwin.
Lafayette ave	Volunteer ave	W. from McKinstry.
Laferty st	Laferty place	Howard to M. C. R. R.
Lambert st	Piquette and Kanter aves	E. from Concord.
Leach st	Croghan st	W. from Crane.
Lernoult st	Farnsworth st	E. from McClellan.
Lincoln ave	Green ave	N. from Holden.
Longyear st	Harper ave	E. from Helen.
Lossing st	Orleans st	N. from Pallister.
Mack ave	Bellair st	W. from Gratiot.
Marston ave	Lincoln ave	W. from St. Aubin.
Mathews st	Macomb st	W. from Helen.
Maxwell ave.	Morton ave	N. from Gratiot.
Merrill st	Seventh st	N. from Lothrop.
Miles st	Trombly ave	E. from Helen.
Moffat st	Frederick st	E from Holcomb.
Morley st	Avery ave	N. from Lothrop.
Morrell st	Theodore st	Bet. River & Fort sts.
Morrow st	Dequindre st	N. from Pallister.
Murray st	Theodore st	E. from McClellan.
Norvell st	Canfield ave	E from Van Dyke.
Oakland ave	Jerome ave	N. from Piquette.
Olney st	Whitaker ave	E. from Russell.
Palmer ave	Ferry ave	E. from Baldwin.
Parker ave	Belle Isle ave	E. from Van Dyke.
Parkman ave	Irving and Fourth aves	W. from Woodward.
Phelps st	Harper ave	E. from Baldwin.
Philadelphia ave.	Moeller st	E. from Russell.
Pollard st.	Horton ave	W. from Jos. Campau.
Ransom st	Canfield ave	E. from Cadillac.
Rivard st	Prospect ave	N. from Pallister.
Rohns ave	Crane ave	N. from Mack.
Seward ave	Fifth ave	W. from Woodward.
Seyburn ave.	Morross ave	S. from Gratiot.
Sherwood ave	Belleview and Cleveland	N. from Harper.
Sidney ave	Whitaker st	E. from Russell.
Sprague st	Willis ave	E. from Van Dyke.
Stanton ave	Seventeenth st	N. from Grand River.
Sterling ave	Trumbull ave	N. from Holden.
Stevens st	Superior st	E from Van Dyke.
Stuart st	Superior st	E. &W. from Concord.
Sylvan st	Gladstone st	E. from Vinewood.
Sylvester st	Alexandrine and De Vogaelaer	E. from Van Dyke.
Taylor ave	Raymond ave	W. from Woodward.
Thirteenth st	Laferty st	S. from Howard.
Tonti ave	Parker st	E.&W. from VanDyke
Walbridge st	Sargent st	E. from Baldwin.
Warren ave	Plymouth road	W. from 24th.
Webb ave	Wilkins ave	W. from Woodward.
Wellington ave	Reutter st	E. from Russell.
Whipple st	Frederick	E. from Baldwin.
Wilbur st	Endicott ave	E. from Lincoln.
Willard st	Hancock ave	E. from Van Dyke.
Wisner st	Harper	E. from Cadillac.

PIPEAGE OF THE CITY OF DETROIT,

ALPHABETED BY STREETS, SHOWING THE SIZE OF IRON AND WOOD PIPE IN USE.

LOCATION.	DIAM. INCHES.	KIND.
A st., e. from Scotten 78 ft	4	iron.
“ Hubbard to Vinewood	4	“
Aberle ave, e. from Russell 349 ft	4	“
Abhott st., Tenth to Cass	24	“
“ w. from Third 20 ft	6	“
“ alley s. of, crossing Sixth	6	“
“ alley s. of, 196 ft. e. of e. of Twelfth to Cass	4	“
Adair st, the River to 10 ft. n. of s. of Jefferson	6	“
“ 10 ft. n. of s., to 29 ft. n. of s. of Jefferson	4	“
Adams ave., John R. to Randolph	6	“
“ Witherell to Hastings		“
“ alley s. of, Cass to 240 ft. e. of Clifford	4	“
“ alley s. of, John R. to Randolph	4	“
Adelaide st., 30 e. of w. of Woodward to 22 ft. e. of w. of Brush	8	“
“ 22 ft. e. of w. of Brush, to 24 ft. e. of w. of Beaubien	10	“
“ 24 ft. e. of w. of Beaubien to Orleans	4	“
“ Orleans to 11 ft. e. of e. of same	18	“
“ 11 ft. e. of e. of Orleans to Gratiot	10	“
“ crossing Gratiot	8	“
Agnes ave., E. Boulevard to Field	4	“
“ Baldwin to Seyburn	6	“
Albert st., Hammond to Wesson	6	“
Alexandrine ave., crossing Grand River	6	“
“ Grand River to alley w. of Commonwealth	6	“
“ alley w. of Commonwealth to alley w. of Trumbull	4	“
“ alley w. of Trumbull to Seventh	6	“
“ Seventh to Sixth	4	“
“ Greenwood to 150 ft. w. of Fourth	4	“
“ 150 ft. w. of Fourth to Fourth	3	“
“ Third to Cass	4	“
“ Cass to Woodward	6	“
“ Woodward to John R.	4	“
“ John R. to 143 ft. w. of w. of Brush (n. side)	6	“
“ 143 ft. w. of, to Brush (n. side)	4	“
“ 143 ft. w. of, to 34 ft. e. of e. of Brush (s. side)	6	“
“ 34 ft. e. of e. of Brush to Beaubien	4	“
“ Beaubien to 15 ft. w. of w. of St. Antoine	3	“
“ 15 ft. w. of w. of St. Antoine, to 20 ft. w. of e. of same.	4	“
“ 20 ft. w. of e. of St. Antoine to Russell	6	“
“ Russell to alley w. of Dubois	4	“
“ alley w. of Dubois to Chene, w. line	3	“
“ w. line of Chene to w. line of Grandy	4	“
“ crossing Grandy	3	“
“ McDougall to alley, e. of	6	“
“ alley e. of McDougall to 367 ft. e. of e. of Moran	4	“

LOCATION.	DIAM. INCHES.	KIND.
Alfred st., Woodward to w. line of Brush	4	iron.
" crossing Brush	6	"
" e. line of Brush to Russell	4	"
" Russell to Orleans	8	"
" Orleans to Dubois	4	"
Alger ave., 16-in. main to e. line of Woodward	6	"
" e. from Woodward 514 ft	4	"
" Russell to 443 ft. e. of Greeley	6	"
Amherst st, 28 ft. e. of w. of Cavalry to 314 ft. w. of Junction	6	"
" 314 ft. w. of w., to Junction	4	"
Amsterdam st., 44 ft. w. of e. of Second to 44 ft. w. of w. of Cass	6	"
" 44 ft. w. of w. to e. line of Cass	4	"
" e. line of Cass to w. line of Woodward	6	"
" crossing Woodward, w. side	4	"
Annexation st., Junction to 540 ft. e. of e. of same	4	"
Anthon st., 260 ft. w. of Campbell to 360 ft. w. of Junction	6	"
" 360 ft. w. of w. to 30 ft. w. of e. of Junction	4	"
Antietam st., Rivard to 22 ft. w. of w. of McDougall	4	"
Antoinette st., crossing Eighteenth, e side	4	"
" e. line of Eighteenth to 28 ft. e. of w. of Stanton	6	"
" Fifteenth to 223 ft. w. of Fourteenth	6	"
" 223 ft. w. of, to Fourteenth	4	"
" Fourteenth 138 ft. w. of Wabash	6	"
" 138 ft. w. of, to Wabash	4	"
" 193 ft. w. of, to Twelfth	4	"
" 43 ft. w. of e. to e. line of Second	4	"
" e. line of Second to Cass	6	"
Arlington pl., Cass to Woodward	4	"
Arndt st., Gratiot to 6 ft. w. of w. of Elmwood	6	"
" 6 ft. w. of w. of Elmwood to Mt. Elliott	4	"
Artillery ave., n. from River st. to Battery	6	"
" crossing Fort	6	"
" 78 ft. s. of s. to n. line of Lafayette	6	"
" 477 ft. s. of s. to Dix	8	"
Ash st., Vinewood to Twenty-seventh	4	"
" Twenty-fourth to e. line of Tillman	4	"
" Maybury to 250 ft. e. of e	4	"
" 250 ft. e. of e. of Maybury to Sullivan	8	"
" Sullivan to Humboldt	4	"
" Humboldt to 166 ft. e. of e. of same	3	"
" 166 ft. e. of e. of Humboldt to e. line of Eighteenth	4	"
" Eighteenth to Seventeenth	8	"
" Seventeenth to Sixteenth	4	"
" crossing Sixteenth and Fifteenth	4	"
" 148 ft. w. of w. to Wabash	4	"
" alley e. of Wabash to Twelfth	6	"
" Twelfth to Harrison	4	"
" National to alley w. of Trumbull	6	"
" alley e. of Trumbull to Grand River	4	"
Atkinson ave., 16-in. main to 21 ft. w. of Woodward	6	"
Atwater st., Shelby to 8 ft. w. of w. of Brush	6	"
" 8 ft. w. of w. of Brush to 149 ft. e. of e. of Rivard	4	"
" 149 ft. e. of Rivard to 33 ft. w. of e. of McDougall	6	"
" alley s. of, alley w. of Bates to Randolph	4	"
Audrain st. (in line of), Clippert to Michigan Brass and Iron Works, 1,808 ft.	4	"
Aurelia st, w. line of Thirteenth to Twelfth st	4	"

LOCATION.	DIAM. INCHES.	KIND.
Avery ave., 215 ft. n. of s. of Willis to 345 ft. n. of Kirby.	6	iron.
“ s. from Piquette 104 ft.	6	“
“ alley w. of, Alexandrine to alley s. of Willis.	4	“
“ alley w. of, Lysander to Bunclark court.	6	“
B st., 313 ft. w. of, to Vinewood.	4	“
Bagg st., Fifteenth to Woodward.	24	“
“ crossing Greenwood on e. side.	4	“
“ e. line of Greenwood to Fifth st	3	“
Bagley ave., Grand River to Park.	8	“
“ alley s. of, Cass to alley w. of Washington.	4	“
Baker st., Scotten to Hubbard.	4	“
“ crossing e. side of Vinewood.	6	“
“ Vinewood to Twenty-fifth.	4	“
“ crossing Twenty-fifth, e. side.	6	“
“ Twenty-fifth to Twenty-fourth.	4	“
“ Twenty-fourth to Seventh.	8	“
“ Eighth to Seventh.	4	“
“ alley s. of, Fourteenth to Wabash	4	“
“ alley s. of, Tenth to Eighth.	3	“
“ alley s. of, Eighth to alley w. of Fourth.	4	“
Baldwin ave., Jefferson to Waterloo.	6	“
“ Mack to Gratiot.	10	“
“ Gratiot to Harper.	8	“
Baltimore ave., w. from Sullivan 297 ft.	4	“
“ Lincoln to w. line of Greenwood.	6	“
“ Greenwood to Woodward.	4	“
“ Woodward to w. line of Brush.	3	“
“ crossing Brush w. side 41 ft.	6	“
“ alley s. of, Greenwood to Forsyth.	6	“
Bancroft ave., 16-in. main to w. line of Woodward.	6	“
Bates st., Atwater to Farmer.	6	“
“ Congress to Champlain.	30	“
“ alley e. of, n. line of Atwater to alley s. of Woodbridge.	3	“
Battery st., Artillery to Dragoon.	6	“
Beacon st., crossing Brush, e side.	6	“
“ Brush to 211 ft. e. of St. Antoine.	4	“
Beals ave., s. from Mack 1,628 ft.	6	“
Beaman st., Crane to alley w. of.	4	“
Beaubien st., Atwater to Champlain, s. line.	6	“
“ crossing Champlain.	8	“
“ n. line of Champlain to Clinton.	6	“
“ Clinton to s. line of Gratiot.	4	“
“ crossing Gratiot, s. side.	6	“
“ Gratiot to 14 ft. s. of n. line Madison.	8	“
“ Madison to 23 ft. s. of n. line of Elizabeth.	4	“
“ 31 ft. s. of n. line of Elizabeth to 28 ft. n. of s. line of Columbia	12	“
“ 28 ft. n. of s. of Columbia to 16 ft. n. of s. of Adelaide.	10	“
“ crossing Adelaide, n. side.	6	“
“ n. line of Adelaide to Watson.	4	“
“ Watson to Harper.	10	“
“ Harper to s. line of Boulevard.	6	“
“ crossing Boulevard, s. side.	10	“
“ 47 ft. s. of n. of Boulevard to Custer.	6	“
Beaufait ave., n. from Jefferson, 585 ft.	6	“
“ 585 ft. n. of Jefferson to 225 ft. s. of Champlain.	4	“
“ 225 ft. s. of Champlain to 263 ft. n. of Kercheval.	6	“
“ s. line of Mack to 190 ft. n. of n. of Forest.	6	“

LOCATION.	DIAM. INCHES.	KIND.
Beaufait ave., crossing N. Boulevard	6	iron.
Beaver st., Vinewood to Twenty-seventh	4	"
Beech st., Seventh to First	4	"
Bellevue ave., Jefferson to 281 ft. n. of n. of Stuart	6	"
" crossing Gratiot	6	"
" Gratiot to 30 ft. s. of n. of Farnsworth	4	"
" crossing N. Boulevard	8	"
Belmont ave., 16-in. main to e. line of Woodward	6	"
" 99 ft. w. of w. to Oakland	6	"
Belvidere ave., crossing Jefferson, n. side	10	"
" n. from Jefferson to 285 ft. n. of n. line	6	"
" 30 ft. s. of n. of St. Paul to 62 ft. n. of n. of Kercheval	6	"
" 67 ft. s. of, to 585 ft. n. of Lorman	6	"
" crossing Mack on s. side	6	"
Benton st., Brush to 8 ft. w. of e. line of Beaubien	8	"
" Beaubien to Russell	4	"
Berlin st., Gratiot to Jos. Campau	8	"
" crossing Jos. Campau	4	"
" Jos. Campau to alley w. of McDougall	6	"
" alley e. of McDougall to Elmwood	8	"
" crossing Elmwood	4	"
" Ellery to Mt. Elliott	4	"
Bethune ave., Hamilton Boulevard to Woodward	6	"
Biddle st., Vinewood to Twenty-seventh	4	"
Blaine ave., 16-in. main to w. line of Woodward	6	"
" w. from Woodward 1,616 ft.	4	"
Boone st., crossing E. Boulevard, e. side 31 ft	6	"
" 314 ft. w. of Collins to w. line of same	4	"
" crossing Collins	6	"
" 284 ft. w. of, to Moran	4	"
Boulevard, between Fort and Myrtle, see West Boulevard.		
" " Twenty-seventh and Hubbard, see Myrtle Boulevard.		
" " Myrtle and North Boulevard, see Hubbard Boulevard.		
" " Hubbard Boulevard and McDougall, see North Boulevard.		
" " North Boulevard and Hendrie, see McDougall Boulevard.		
" " McDougall and Frontenac, see Hendrie Boulevard.		
" " Hendrie and Jefferson, see Frontenac Boulevard.		
Bowen ave., Jefferson to 50 ft. s. of Chapaton	6	"
Bradley st., w. from Crane 211 ft	4	"
Brady st., Woodward to 3 ft. w. of w. of Brush	6	"
" 3 ft. w. of w. to 18 ft. w. of e. of Beaubien	8	"
" Beaubien to Russell	4	"
Brainard st., Trumbull to e. line of Seventh	6	"
" e. line of Seventh to Sixth	4	"
" Greenwood to alley w. of Fourth	8	"
" alley w. of, to 16 ft. w. of e. of Fourth	4	"
" 16 ft. w. of e. of Fourth to 17 ft. e. of w. of Third	6	"
" Third to Cass	4	"
Brandon pl., 114 ft. w. of w. of to Moran	6	"
Brandon ave. (west), Campbell to Junction	6	"
" " Junction to Hubbard	4	"
Bratshaw st., 15 ft. w. of e. of Fourth to 28 ft. e. of w. of Third	10	"
Breckenridge st., w. from Humboldt 74 ft	4	"
" Humboldt to Eighteenth	6	"
" Eighteenth to 148 ft. w. of Sixteenth	4	"
" 148 ft. w. of Sixteenth to Sixteenth	6	"
" Fifteenth to 140 ft. w. of Fourteenth	6	"

LOCATION.	DIAM. INCHES.	KIND.
Breckenridge st., 140 ft. w. of to Fourteenth	4	iron.
Brevoort pl., Twenty-second to alley e. of	6	"
" Nineteenth to alley w. of Eighteenth	4	"
Brewster st., crossing e side of Brush	6	"
" e. line of Brush to Russell	4	"
" Riopelle to Gratiot	4	"
Brinket st, Crane to Hibbard	6	"
Bristol pl., Twenty-second to Twenty-first	4	"
Bruce st., 2 ft. w. of alley w. of to Crane	4	"
Brush st., Atwater to Jefferson	6	"
" crossing Jefferson	8	"
" Jefferson to Congress	4	"
" Congress to Gratiot	8	"
" Gratiot to 28 ft. n. of s. of Madison	4	"
" Madison to 10 ft. s. of n. of Elizabeth	8	"
" Elizabeth to s. line of Adelaide	4	"
" crossing s. side Adelaide	6	"
" 15 ft. n. of s. of Adelaide to 21 ft. s. of n. of Edmund	10	"
" Edmund to Watson	24	"
" Watson to Benton	6	"
" 15 ft. n. of s. of Benton to 28 ft. s. of n. of Rowena	8	"
" Brady to 3 ft. n. of s. of Alexandrine	8	"
" 3 ft. n of s. Alexandrine to 230 ft. n. of Milwaukee	6	"
" 230 ft. n. of Milwaukee to 24-in. main in N. Boulevard	8	"
" crossing Palmer, both sides	4	"
" Horton to Hamlin	4	"
" crossing Chandler.	6	"
Bryant st., e. from Wabash 125 ft	6	"
" 125 ft. e. of Wabash to Twelfth	4	"
Buchanan st., Livernois to Vinewood	16	"
" Vinewood to Grand River	30	"
" Twenty-eighth to Scotten	4	"
" Twenty-fourth to Twenty-third	4	"
" Williams to e. line of Maybury.	4	"
" e. line of Maybury to 75 ft. e. of Sullivan	3	"
" 387 ft. w. of Humboldt to Eighteenth	4	"
" 169 ft. w. of, to Seventeenth	4	"
" Fifteenth to Wabash	4	"
" alley s of, Joe to Howell	6	"
Bunclark court, alley w. of Avery to Twelfth	6	"
Burlage pl., Waterloo to Cleveland	8	"
Bushey st., Michigan to 21 ft. n. of s. of Julia	6	"
Butternut st., Twenty-fourth to Fifteenth	24	"
" Williams to 227 ft. e. of Maybury	4	"
" e. from Seventeenth 144 ft	4	"
" e. from Wabash 263 ft.	4	"
" National to alley w. of Trumbull	4	"
" alley e. of Trumbull to Seventh	4	"
C st., Hubbard to Vinewood	4	"
Cadillac ave., Pumping Works to Mack	42	"
" crossing Jefferson to n. line	6	"
" 1,000 ft. n. of to 2,050 ft. n. of Jefferson	6	"
" 95 ft. s. of to Harper	6	"
Cadillac square, s. side, Woodward to Randolph	24	"
" n. side, Monroe to Bates	6	"
" alley n. of, from second alley e. of Woodward to Randolph	4	"

LOCATION.	DIAM. INCHES.	KIND.
Cadillac square, alley s. of, alley e. of Woodward to Bates	4	iron.
Calumet ave., w. line of Twelfth to 196 ft. e. of same	4	“
“ crossing Lincoln	4	“
“ Eighth to Fourth	4	“
“ Grand River to Third	30	“
Calvert ave., crossing Woodward to w. line	6	“
Cameron ave., 24-in. main to 132 ft. n. of N. Boulevard	6	“
“ 132 ft. n. of N. Boulevard to Clay	4	“
“ Clay to 23 ft. n. of Koch	6	“
Campau st., River to Fort	6	“
“ n. from Dix 448 ft	4	“
Campbell ave., River to Dunn	6	“
“ Michigan to 161 ft. n. of Herbert	6	“
Canfield ave., Thirteenth to 48 ft. e. of same	4	“
“ 48 ft. e. of Thirteenth to Twelfth	8	“
“ crossing Seventh	4	“
“ e. line of Seventh to Sixth	8	“
“ Greenwood to Fourth	4	“
“ Third to Woodward	4	“
“ Third to Woodward	30	“
“ Woodward to Collins	42	“
“ Woodward to 767 ft. w. of Mt. Elliott	6	“
“ 767 ft. w. of to Mt. Elliott	4	“
“ Canton to 9 ft. w. of Helen	6	“
“ alley s. of, from Hastings to alley e. of same	8	“
Caniff ave., 16-in. main to w. line of Woodward	6	“
“ w. of w. line of Woodward 27 ft	4	“
Canton ave, Jefferson to 210 ft. n. of Kercheval	6	“
“ crossing Mack	6	“
“ 23 ft. s. of n. of Stuart to Gratiot	6	“
“ Hancock to 168 ft. n. of Frederick	6	“
“ Medbury to Piquette	6	“
“ crossing N. Boulevard	6	“
Caroline st., Thirteenth to 192 ft. w. of Twelfth	6	“
“ 192 ft. w. of to Twelfth	3 & 4	“
Cass st., Woodbridge to Jefferson	8	“
“ Jefferson to Fort	24	“
“ alley n. of Michigan to Spencer	4	“
“ alley w. of, from alley s. of Spencer to Lewis	4	“
Cass ave., Jefferson to Columbia	10	“
“ Columbia to Gilman	16	“
“ Gilman to Joy	10	“
“ Joy to Alexandrine	8	“
“ Alexandrine to 16 ft. s. of s. line of Canfield	6	“
“ crossing Canfield 48 ft	8	“
“ 32 ft. n. of s. of Canfield to 19 ft. n. of n. of Warren	6	“
“ 19 ft. n. of Warren to 34 ft. n. of s. of Kirby (east)	10	“
“ from Kirby (east) to Kirby (west)	12	“
“ 21 ft. n. of s. of Kirby (west) to 20 ft. n. of s. of Holden	10	“
“ 20 ft. n. of s. of Holden to 118 ft. s. of D. & B. C. R. R.	6	“
“ 118 ft. s. of D. & B. C. R. R. to Milwaukee	8	“
“ s. line of N. Boulevard to 24-in. main	8	“
“ west side, crossing Forest and Putnam	4	“
“ alley w. of, alley s. of Elizabeth to 119 ft. s. of Gilman	4	“
“ alley w. of, 119 ft. s. of to Gilman	8	“
“ alley w. of, Ledyard to Bagg	4	“

LOCATION.	DIAM. INCHES.	KIND.
Catherine st., Gratiot to Hastings	12	iron.
" Hastings to Rivard	4	"
" crossing Rivard	6	"
" Rivard to w. line of Dequindre	4	"
" w. line of Dequindre to e. line of St. Aubin	6	"
" e. line of St. Aubin to Elmwood	4	"
Cavalry ave., Lafayette to Amherst	6	"
" Regular to n. line of Dix	6	"
" n. line of Dix to Toledo	4	"
Celeron st., 274 ft. w. of Campbell to Junction	4	"
Celia st., Wabash to 4 ft. e. of e. line of same	4	"
" 4 ft. e. of e. of Wabash to Thirteenth	3	"
" Thirteenth to Twelfth	4	"
Champlain st., Randolph to St. Aubin	30	"
" Randolph to alley e. of same	4	"
" St. Antoine to Orleans	4	"
" Orleans to Elmwood	6	"
" Elmwood to 250 ft. w. of Leib st	4	"
" 250 ft. w. of to Leib	3	"
" Leib to 50 ft. e. of w. of Frontenac Boulevard	4	"
" crossing Frontenac Boulevard roadway 50 ft	6	"
" 50 ft. w. of e. of Frontenac Boulevard to Field	4	"
" Field to e. line of Baldwin	6	"
" Seyburn to Shipherd	6	"
" alley s. of, alley e. of Randolph to St. Antoine	4	"
Chandler ave., Woodward to Oakland	6	"
Charles st., Seventh to Sixth	4	"
Charlevoix st., Chene to e. line of Jos. Campau	4	"
" e. line of Jos. Campau to alley w. of McDougall	3	"
" alley e. of McDougall to Elmwood	4	"
" Ellery to Mt. Elliott	4	"
" 142 ft. w. of to Concord	4	"
Charlotte ave., Fifth to 131 ft. w. of Fourth	4	"
" 131 ft. w. of to Fourth	3	"
" alley e. of Third to Woodward	4	"
Chase st., crossing Russell, e. side	4	"
" e. line of Russell to w. line of Riopelle	3	"
" crossing w. side of Riopelle	4	"
Chene st., Atwater to s. line of N. Boulevard	6	"
" Congress to Canfield	30	"
Cherry st., Twelfth to Harrison	4	"
" National to alley w. of Trumbull	3	"
" alley w. of Trumbull to Seventh	4	"
" Seventh to Grand River	16	"
Chestnut st., Russell to Elmwood	4	"
Chipman st., Nineteenth to alley w. of Eighteenth	4	"
Chicago Boulevard, crossing Woodward from 16-inch main to e. line	6	"
Chope pl., Twenty-fourth to 167 ft. w. of Grand River	6	"
" 167 ft. w. of, to Grand River	4	"
Christiancy st., Morrell to Ferdinand	6	"
" Ferdinand to 122 ft. e. of e. of same	4	"
" 122 ft. e. of e. of Ferdinand to Lansing	6	"
" Lansing to 134 ft. e. of e. of same	4	"
" 134 ft. e. of e. of Lansing to McKinstry	6	"
Church st., crossing Eleventh st	4	"
" 79 ft. w. of w. of Tenth to e. line of same	4	"
" alley s. of, Tenth to Eighth	4	"

LOCATION.	DIAM. INCHES.	KIND.
Clairmont ave., 175 ft. w. of to Hamilton Boulevard	6	Iron.
“ 1,275 ft. w. of w. of Woodward to w. line of same	4	“
“ w. line to 16-in. main in Woodward	6	“
Clark ave., River to s. line of M. C. R. R	8	“
“ s. line of M. C. R. R. to Michigan ave	6	“
“ Michigan Peninsular Car Works to Michigan ave	4	“
“ 20 ft. n. of s. of Rich (east) to 25 ft. n. of s. of Rich (west), 78 ft	6	“
Clark park, 292 ft. w. of to Scotten	4	“
“ e. from Clark 282 ft	4	“
“ n. and s. from 4-inch pipe 607 ft	3	“
Clay ave., 16-in. to 8-in. in Woodward	8	“
“ Woodward to Oakland	8	“
“ Oakland to 393 ft. e. of St. Aubin	6	“
Cleveland st., St. Aubin to Elmwood	10	“
“ Elmwood to Burlage pl	8	“
Cleveland pl., crossing Greenwood, e side	4	“
“ e. from Greenwood 264 ft	3	“
Clifford st., Sproat to Park pl	4	“
“ alley w. of Griswold to e. line of Washington	4	“
“ Washington to Woodward	12	“
Clinton st., Gratiot to Rivard	10	“
“ Rivard to Orleans.	16	“
“ Orleans to Elmwood	8	“
“ alley s. of, alley w. of Brush to St. Antoine	4	“
Clippert st., n. from Dennis 481 ft	4	“
Coe ave., Van Dyke to Parker	6	“
Colby ave., crossing Russell (e. side)	4	“
Collins st., Gratiot to Canfield	42	“
“ Canfield to Griffin	30	“
“ Leland to Canfield	4	“
“ n. from Canfield 563 ft	3	“
“ 563 ft. n. of Canfield to 26 ft. n. of Hancock	4	“
“ s. from Harper 150 ft	6	“
Columbia st., Cass to Park	16	“
“ Park to Woodward	4	“
“ Woodward to Rivard	6	“
“ alley s. of, Cass to Woodward	6	“
Columbus ave., s. from Fort 570 ft	3	“
“ crossing Fort	4	“
Commonwealth ave., crossing Grand River	6	“
“ (w side) Alexandrine to Calumet	6	“
“ crossing Forest 42 ft.	12	“
“ (both sides), crossing Hancock n. to s. line	6	“
“ s. line of Putnam to Merrick	6	“
“ s. line of Kirby to 7 ft. n. of Stanley	6	“
“ 439 ft. s. of Piquette to Holden	6	“
Concord ave., Jefferson to Mack	6	“
“ Sylvester to s. line of Harper	6	“
Congress st., Sixth to Bates	30	“
“ Randolph to St. Aubin	24	“
“ St. Aubin to Meldrum	42	“
“ Bates to Brush	4	“
“ St. Antoine to Mt. Elliott (e. line)	4	“
“ 171 ft. w. of to Helen	4	“
“ e. side of Frontenac Boulevard to Field	4	“
“ alley s. of, Seventh to Sixth	4	“
“ alley s. of, Fourth to 250 ft. e. of same	4	“

LOCATION.	DIAM. INCHES.	KIND.
Congress st., alley s. of, Third to Griswold	4	iron.
" alley s. of, 80 ft. w. of Brush to St. Antoine	4	"
Conger st., 27 ft. w. of e. of Van Dyke to 168 ft. w. of w. of same	6	"
Cook st., e. from Welch 289 ft.	4	"
" 289 ft. e. of Welch to Hammond	6	"
Cracow pl., alley e. of Hastings to Rivard	6	"
Craig ave., n. from Trombly 378 ft.	3	"
" 378 ft. n. of Trombly to Milwaukee	6	"
Crane ave., Jefferson to Mack	8	"
Crary st., 211 ft. w. of to Crane	4	"
Crystal st., Trombly to Milwaukee	4	"
Custer ave., e. from Woodward 298 ft.	4	"
" 298 ft. e. of Woodward to John R.	6	"
" John R. to 307 ft. e. of same	4	"
" 307 ft. e. of John R to Brush	6	"
" Brush to Hastings	4	"
" Rivard to 126 ft. e. of same	4	"
" 126 ft. e. of Rivard to Russell	6	"
Cutler st., e. from McClellan 460 ft.	4	"
D st., 300 ft. w. of to Vinewood	4	"
Dalzelle st., Twenty-fourth to Twenty-third	4	"
" Twenty-third to Twenty-second	6	"
" Twenty-second to Foundry	4	"
" Thirteenth to Twelfth	8	"
" crossing Twelfth	4	"
Dane st., crossing Collins e. side	6	"
" e. line of Collins to 338 ft. e. of Moran	4	"
" crossing Mt. Elliott from w. to e. line	6	"
Davenport st., Cass to Woodward	4	"
Davis pl., Theodore to alley s. of same	4	"
Delaware ave., 300 ft. w. of w. line of Second ave., to 44 ft. w. of e. of Woodward	6	"
Deming st., e. from Scotten 368 ft.	4	"
Dennis st., Clippert to Livernois	4	"
Dequindre st., Woodbridge to Jefferson	6	"
" w. side Jay to Waterloo	4	"
" e. side Waterloo to Gratiot	4	"
" s. from Adelaide 206 ft.	4	"
" Alfred to Pierce	4	"
" Canfield to Willis	4	"
" alley e. of, s. from 266 ft.	4	"
Detloff court, crossing Hancock, n. side	4	"
" Hancock to 270 ft. n. of n. of same	3	"
Devereaux st., Thirty-first to Thirtieth	6	"
Dillon ave., n. from Holden 687 ft.	6	"
Division st., crossing Brush, e. side	6	"
" e. line of Brush to St. Aubin	4	"
Dix ave., Artillery to Twenty-fourth	10	"
" (n side), crossing W. Boulevard 130 ft.	6	"
" crossing Twenty-third	6	"
Dragoon ave., n. from River st. 563 ft.	6	"
" Hussar to n. line of Dix	6	"
Driggs ave., Campbell crossing w. side	6	"
" Campbell to Junction	4	"
Dry Dock st., Swain to Lady's lane	4	"
Dubois st., Atwater to Clinton	6	"
" Clinton to Hunt	8	"

LOCATION.	DIAM. INCHES.	KIND.
Dubois st., Hunt to n. line of Leland	6	Iron.
" n. line of Leland to s. line of Canfield	3	"
" Canfield, crossing s. side 40 ft.	6	"
" 40 ft. n. of s. of Canfield to 25 ft. n. of s. of Farnsworth	16	"
" Farnsworth crossing n. side from 16-in main to n. line 48 ft.	8	"
" n. line of Farnsworth to 188 ft. n. of Frederick	4	"
" 188 ft. n. of Frederick to Ferry	6	"
" Ferry to Hendrie	4	"
" Hendrie to 100 ft. s. of Medbury	6	"
" 100 ft. s. of Medbury to 20 ft. s. of Harper	4	"
" 20 ft. s. of Harper to 23 ft. n. of s. of Trombly	8	"
" crossing N. Boulevard	8	"
Duffield st., Cass to Woodward	4	"
Dumontier st., e. from Crane 297 ft.	4	"
" 297 ft. e. of to 336 ft. e. of Crane.	6	"
Dunn st., Wesson to Campbell	3	"
Durand st., 29 ft. w. of e. of Van Dyke to 372 ft. w. of w. of same	6	"
E st., Hubbard to Vinewood	4	"
" crossing W. Boulevard from 5 ft. e. of w. to 2 ft. w. of e.	6	"
" e. line of W. Boulevard to Twenty-sixth	4	"
" Twenty-sixth to Twenty-fifth.	6	"
Edison ave., 16-inch main in Woodward to w. line of same	6	"
Edmund pl., Woodward to Brush	24	"
Eighth st., River st. to Michigan	8	"
" Michigan to Cherry	4	"
" Grand River to Calumet	8	"
" crossing s. side of Calumet 40 ft	6	"
" Calumet to Lysander	4	"
Eighteenth st., Fort to s. line of Myrtle	6	"
" s. to n. line of Myrtle.	8	"
" Myrtle to 50 ft. n. of Linden	6	"
" 50 ft. n. of, to 370 ft. n. of Linden	3	"
" 370 ft. n. of, to 468 ft. n. of Linden	4	"
" 468 ft. n. of Linden to n. line of Buchanan	6	"
" n. line of Buchanan to s. line of Hancock	4	"
" crossing s side of Hancock	6	"
" Grand River to N. Boulevard (s. line)	6	"
" crossing N. Boulevard	8	"
" n. from N. Boulevard 228 ft.	6	"
" alley w. of, Brevoort to Webster pl.	4	"
" alley w. of, St. Clair to Wing pl.	4	"
" alley w. of, Chipman to Johnson	4	"
Eighteenth-and-a-half st., s. from River 504 ft.	3	"
" River to Fort st	4	"
Eleventh st., Leverette to Michigan	6	"
Eliot st., Woodward to 29 ft. w. of e. of John R.	6	"
" John R. to Riopelle	4	"
Ellery st., Waterloo to Charlevoix	6	"
" Arndt to Berlin	6	"
" Heidelberg to Schneider pl.	6	"
" s. line of Mack to Pulford	6	"
" Zender to Gratiot	6	"
" crossing Hendrie Boulevard	6	"
Ellery pl., Forest to Hancock	3	"
Elizabeth st., Grand River to Cass	8	"
" 22 ft. e. of w. of Park to 20 ft. e. of w. of Brush	8	"
" Brush to Beaubien	4	"

LOCATION.	DIAM. INCHES.	KIND.
Elizabeth st., (both sides), alley e. of Woodward to 177 ft. w. of w. of Brush	4	iron.
" Beaubien to St. Antoine	12	"
" St. Antoine to Hastings	4	"
" alley s. of, 100 ft. w. of Cass to Woodward	4	"
" alley s. of, alley e. of Woodward to Witherell	3	"
" alley s. of, John R. to Randolph	4	"
Elm st., alley e. of Wabash to Harrison	4	"
" Harrison to National	6	"
" National to alley w. of Trumbull	4	"
" alley e. of Trumbull to Seventh	4	"
Elmwood ave., Jefferson to Monroe	4	"
" Monroe to Maple	6	"
" Waterloo to Hunt	4	"
" Hunt to Gratiot	6	"
Emmons st., McClellan to Pennsylvania	4	"
Endicott ave., crossing e. side of Woodward	4	"
" crossing w. side of John R.	6	"
Englewood ave, crossing Woodward e. side	6	"
" e. line of Woodward to w. line of Oakland	4	"
" e. from w. line of Oakland 30 ft	6	"
Erie pl., crossing w. side of Moran 23 ft	6	"
Erskine st., Woodward to Russell	4	"
" Russell to 159 ft. w. of Riopelle	6	"
" 159 ft. w. of to Riopelle	4	"
" Dequindre to w. line of Chene	4	"
" w. line of Chene to Grandy	8	"
Euclid ave., 520 ft. w. of to Woodward	6	"
Exposition Grounds, s. from River st. 948 ft	4	"
F st., 140 ft. w. of to Vinewood	4	"
" crossing roadway of Vinewood 27 ft	6	"
Fairbanks st., e. from Scotten 364 ft	4	"
Farmer st., Bates to Gratiot	6	"
" 15 ft. s. of to 38 ft. n. of 30-in. main in Gratiot	8	"
Farnsworth st., Woodward to Rivard	6	"
" Rivard to Dubois	16	"
" crossing e. side of Dubois	6	"
" e. line of Dubois to Grandy	4	"
" Mitchell to McDougall	4	"
" crossing Collins	6	"
" Collins to Moran	3 & 4	"
" crossing e. side of Moran 29 ft.	6	"
" crossing Mt. Elliott from w. line to 14 ft. w. of e. 51 ft	6	"
" 162 ft. w. of to Concord	6	"
" Canton to Helen	4	"
" crossing Frontenac Boulevard	6	"
" alley s. of, or first st. s. of, crossing w. side of Moran	6	"
Farrand st., e. from McClellan 513 ft	6	"
Ferdinand st., n. from River 975 ft	4	"
" 975 ft. n. of River to 493 ft. s. of s. line of Fort	6	"
" 493 ft. s. of s. of to Fort	4	"
" Porter to 140 ft. n. of Christiancy	6	"
" 360 ft. s. of to 309 ft. n. of Dix	6	"
Ferry ave., Woodward to Russell	4	"
" Russell to St. Aubin	8	"
" St. Aubin to Mitchell	4	"
" 60 ft. w. of w. of Collins to w. line of same	6	"
" w. line of Collins to 82 ft. e. of e. of same	8	"

LOCATION.	DIAM. INCHES.	KIND.
Ferry ave., 247 ft. w. of to Moran	4	Iron.
" crossing e. side of Moran	6	"
" crossing Mt. Elliott, from main to main, 39 ft	6	"
" 24 ft. e. of w. of to 222 ft. e. of e. of Helen	6	"
" crossing Frontenac Boulevard	8	"
" Townsend to Baldwin	6	"
" alley s. of, 168 ft. w. of to Secor pl	4	"
Field ave., Jefferson to 740 ft. n. of Waterloo	6	"
" 4 ft. s. of Mack to 177 ft. n. of Medbury	6	"
Fifth st., Congress to alley n. of	8	"
" alley s. of to alley n. of Lafayette	4	"
" Abbott to Cherry	6	"
" Cherry to Noble	4	"
" both sides of Crawford Park	4	"
" Holden to 144 ft. s. of Piquette	4	"
" 144 ft. s. of to Piquette	6	"
Fifteenth st., Fort to n. line of Grand River	6	"
" Bagg to Buchanan	24	"
" n. from Warren 348 ft	6	"
" Kirby to Harper	6	"
" crossing N. Boulevard	6	"
Finley st., 433 ft. w. of to Jos. Campau	4	"
First st., Front to Woodbridge	6	"
" Woodbridge to alley n. of Jefferson	8	"
" Jefferson to s. line of Congress	4	"
" crossing Congress	8	"
" n. line of Congress to Fort	4	"
" Fort to Grand River	6	"
" alley w. of, alley s. of to Spencer	4	"
" alley w. of, alley s. of to Prentiss	4	"
Fischer ave., Jefferson to 90 ft. n. of Beaman	6	"
" crossing Mack from 42-in. to 8-in. main	8	"
" n. from Mack 1,483 ft.	6	"
Florence st., Harper to Piquette	4	"
Florene st., Shipherd to Van Dyke	6	"
Flower st., crossing Forest, s. to n. line	4	"
" n. from Forest 260 ft	3	"
" 260 ft. n. of Forest to Hancock	6	"
Forest ave., Fourteenth to alley w. of Wabash	6	"
" 2 ft. w. of w. of Wabash to 190 ft. w. of Twelfth	6	"
" 190 ft. w. of Twelfth to Avery	4	"
" Avery to Commonwealth	6	"
" Commonwealth to Trumbull	8	"
" crossing Trumbull	4	"
" Lincoln to Seventh	6	"
" Seventh to Fourth	4	"
" Third to Cass, both sides	4	"
" Cass to 373 ft. w. of Rivard	4	"
" 373 ft. w. of to Rivard	6	"
" Russell to w. line of Dubois	4	"
" crossing Dubois from e. to w	6	"
" e. line of Dubois to 190 ft. w. of Grandy	4	"
" 190 ft. w. of Grandy to e. line of same	6	"
" McDougall to e. line of Collins	6	"
" e. line of Collins to Moran	4	"
" Moran to 157 ft. w. of Beaufait	6	"
" 157 ft. w. of to Beaufait	4	"

LOCATION.	DIAM. INCHES.	KIND.
Forest ave., e. from Baldwin 164 ft.	4	iron.
“ alley s. of, St. Antoine to 374 ft. w. of Hastings	6	“
“ alley s. of, 374 ft. w. of to Hastings	4	“
Forsyth ave., Baltimore to alley s. of same	6	“
Fort st., w. line of Artillery to Twenty-fourth	8	“
“ Twenty-fourth to Hoffman	6	“
“ Hoffman to Fourteenth	8	“
“ Fourteenth to Tenth	6	“
“ Tenth to Seventh	12	“
“ Seventh to Woodward	16	“
“ Griswold to Woodward	4	“
“ St. Antoine to Meldrum	4	“
“ 168 ft. w. of to Helen	4	“
“ alley s. of, Eighth to Seventh	4	“
“ alley s. of, Seventh to Fifth	8	“
“ alley s. of, 10 ft. w. of Third to Cass	4	“
“ alley s. of, Cass to Shelby	6	“
“ alley s. of, Shelby to alley w. of Woodward	4	“
Foundry st., Baker to Michigan	6	“
Fourth st., Woodbridge to Larned	4	“
“ Larned to Congress	8	“
“ Fort to Grand River	6	“
“ alley w. of, Labrosse to alley s. of Michigan	4	“
Fourth ave., Grand River to Bagg	4	“
“ Bagg to Calumet	6	“
“ Calumet to s. line of Kirby	4	“
“ s. to n. line of Kirby	6	“
“ n. line of Kirby to 21 ft. s. of n. of Bratshaw	4	“
“ 21 ft. s. of n. of Bratshaw to 13 ft. s. of n. of Holden	10	“
“ alley w. of, Brainard to alley n. of	4	“
“ alley w. of, Selden to alley s. of	4	“
“ alley w. of, Lysander to Prentiss	8	“
Fourteenth ave., Fort to Lafayette	8	“
“ Lafayette to Bagg	10	“
“ Bagg to Grand River	8	“
“ Grand River to s. line of N. Boulevard	6	“
“ s. to n. line of N. Boulevard	8	“
“ (w. side), n. from Porter 402 ft.	4	“
Fox st., Frank to Alexandrine	3 & 4	“
Frank st., Seventh to 23 ft. e. of w. of Sixth st	6	“
“ Sixth to Fourth	4	“
Franklin st., Randolph to Beaubien	4	“
“ Beaubien to Orleans	6	“
“ Orleans to 25 ft. e. of Dequindre	4	“
“ 25 ft. e. of Dequindre to McDougall	6	“
“ Walker to Adair	4	“
“ 325 ft. w. of to Leib st	4	“
“ alley s. of, McDougall to Walker	4	“
Frederick st., Woodward to 124 ft. e. of Riopelle	4	“
“ 124 ft. e. of Riopelle to 139 ft. e. of same	6	“
“ 252 ft. w. of St. Aubin to Jos. Campau	4	“
“ Collins to 126 ft. e. of Moran	6	“
“ Helen to 69 ft. w. of w. of Frontenac Boulevard	4	“
“ connecting two mains in Mt. Elliott ave	6	“
Fremont pl., Collins to 448 ft. w. of Moran	6	“
“ 448 ft. w. of to Moran	4	“
Front st., Third to 107 ft. e. of same	6	“

LOCATION.	DIAM. INCHES.	KIND.
Front st., Second to 170 ft. e. of First	4	iron.
Frontenac Boulevard, (w. side), s. from 42-in. main in Jefferson to B. I. Park	10	"
" (w. side), crossing Jefferson ave. from main to n. line	6	"
" (w. side), main in Mack to n. line	4	"
" (w. side), s. to n. line of Gratiot.	6	"
" (w. side), crossing Farnsworth, Ferry & Hendrie,	8	"
" (e. side), 424 ft. s. of to 220 ft. s. of Jefferson	3	"
" (e. side), 220 ft. s. of Jefferson to 30 ft. s. of n. of St. Paul	6	"
" (e. side), s. of Mack, crossing Boulevard 76 ft.	6	"
" (e. side), Mack, 22 ft. s. of n. to s. line	6	"
" (e. side), 4-in. main to 18 ft. n. of n. line	4	"
" (e. side), 29 ft. s. of s. of Gratiot to Gratiot	4	"
" (e. side), n. from Gratiot 53 ft	6	"
" (e. side), crossing Farnsworth and Hendrie Boulevard	6	"
" crossing Frontenac Boulevard 424 ft. s. of and 220 ft. s. of	3	"
Frontenac ave., s. from Medbury 93 ft	6	"
Galster st., Canfield to Forest	6	"
Garfield ave., Woodward to 367 ft. e. of e. of John R.	4	"
" 367 ft. e. of e. of John R. to 10 ft. w. of Brush	6	"
" 10 ft. w. of Brush to e. line of Brush	4	"
" e. line of Brush to 222 ft. w. of Beaubien.	6	"
" 222 ft. w. of Beaubien to e. line of St. Antoine	4	"
" e. line of St. Antoine to 346 ft. w. of Hastings	6	"
" 346 ft. w. of to Hastings	3	"
" Hastings to w. line of Dubois	4	"
" crossing Dubois w. to e. line	6	"
" e. line of Dubois to Chene, w. line	4	"
" w. line of Chene to e. line of Grandy	6	"
" e. from McDougall 218 ft	4	"
" crossing Collins	6	"
" 188 ft. w. of Galster to 213 ft. w. of Moran	6	"
" 213 ft. w. of to Moran	4	"
" crossing Moran, e. side	6	"
" crossing Mt. Elliott 53 ft	6	"
" 182 ft. w. of to Beaufait	4	"
" alley s. of, Second to 150 ft. e. of same,	3	"
" alley s. of, St. Antoine to 374 ft. w. of Hastings	6	"
" alley s. of, 374 ft. w. of to Hastings	4	"
" alley s. of, Hastings to 335 ft. e. of same	3	"
Gilman st., Grand River to Cass	16	"
Gladstone ave., 803 ft. w. of to 16-inch main in Woodward	6	"
Glynn ct., 300 ft. w. of to the w. line of Woodward	4	"
" w. line of Woodward to 16-inch main	6	"
Goethe st., Orane to Holcomb	4	"
" e. from McClellan 228 ft	4	"
Goldner ave., Michigan to G. T. R. R	6	"
Grand River ave., Woodward to Cass	8	"
" Cass to Third	6	"
" Third to 400 ft. w. of Humboldt	8	"
" 400 ft. w. of Humboldt to Vinewood	6	"
" Vinewood to N. Boulevard	10	"
" N. Boulevard to city limits	6	"
" Calumet to Buchanan	30	"

LOCATION.	DIAM. INCHES.	KIND.
Grand River ave., connecting 30-in. with 8-in. in Buchanan, 22 ft	8	iron.
“ (s. side), Second to 56 ft. e. of Cherry	4	“
“ (n. side), e. from Eighth 110 ft	3	“
“ alley e. of, 10 ft. n. of Bagley to alley n. of Bagley	4	“
“ alley e. of, Fourth to Union	4	“
“ alley e. of, w. from Lincoln 47 ft	4	“
“ alley e. of, Trumbull to alley w. of same	6	“
“ alley e. of, Wabash to alley w. of same	6	“
Grandy ave., Gratiot to Pierce	8	“
“ Pierce to Harper	6	“
“ n. from Harper 322 ft	4	“
“ 322 ft. n. of Harper to Chene	6	“
Granger st., e. from Baldwin 259 ft	6	“
“ 259 ft. e. of Baldwin to Van Dyke	4	“
Grant ct., n. from Warren 318 ft	4	“
Grant st., Thirteenth to Twelfth, w. line	8	“
“ crossing w. side of Twelfth	4	“
Granville pl., Wabash to e. line of same	4	“
“ e. line of Wabash to Thirteenth	8	“
Gratiot ave., Woodward to Raynor	30	“
“ Raynor to w. line of Rivard (s)	10	“
“ w. line of Rivard (s) to St. Aubin	12	“
“ Woodward to Brush	10	“
“ Brush to 64 ft. w. of Sheridan	6	“
“ 64 ft. w. of Sheridan to 266 ft. w. of Harper	8	“
“ 266 ft. w. of Harper to Cadillac	6	“
“ alley s. of, alley e. of Woodward to Farmer	4	“
“ alley s. of, Farmer to alley e. of Farrar	6	“
Greenwood ave., Bagg to Calumet	6	“
“ crossing Calumet	8	“
“ n. line of Calumet to N. Boulevard	6	“
Griffin st., see North Boulevard.		
Griswold st., Detroit River to Atwater	3	“
“ Atwater to State	6	“
“ 25 ft. n. of n. of Grand River to 16 ft. s. of s. of Clifford	8	“
“ 16 ft s. of s. line of Clifford to 12-in. main in Clifford	10	“
Grummond ave., Hamilton Boulevard to 16-in. main in Woodward	6	“
Guilloz st., Clay to Sidney	6	
Guoin st., Russell to Orleans	4	‘
“ Orleans to McDougall	10	“
“ McDougall to Walker	6	“
Haigh ave., 16-in. main to e. line of Woodward	6	“
“ e. line of Woodward to 158 ft. e. of same	4	“
“ Russell to 365 ft. e. of Greeley	6	“
Hale st., Riopelle to St. Aubin	6	“
“ e. from St. Aubin 275 ft	4	“
“ 275 ft. e. of St. Aubin to Dubois	3	“
“ Dubois to Chene	4	“
“ Chene to Grandy	3	“
“ Grandy to Jos. Campau	6	“
Hamilton ave., Mack to 692 ft. n. of Canfield	6	“
Hamilton Boulevard, crossing N. Boulevard	10	“
“ n. line of N. Boulevard to 26 ft. s. of s. line of Blaine	4	“
“ 26 ft. s. of s. of Blaine to Bancroft	10	“
Hamlin ave., Woodward to Oakland	4	“
Hammond ave., Toledo to s. line of L. S. & M. S. R. R.	6	“
“ 356 ft. s. of Leavitt to 175 ft. n. of Ranspach	6	“

LOCATION.	DIAM. INCHES.	KIND.
Hammond ave., Poplar to Horatio	6	Iron.
Hancock ave., Scotten to La Salle	4	"
" crossing Hubbard Boulevard 165 ft.	6	"
" w. line of Vinewood to Twenty-sixth	4	"
" Twenty-fifth to e. line of Twenty-fourth	4	"
" Twenty-third to 155 ft. e. of e. line of same	4	"
" 155 ft. e. of e. of Twenty-third to 20 ft. w. of e. of Williams	6	"
" Eighteenth to Seventeenth	4	"
" crossing Fourteenth	4	"
" Fourteenth to w. line of Wabash	8	"
" w. line of Wabash to 130 ft. w. of Thirteenth	6	"
" 130 ft. w. of Thirteenth to Avery	4	"
" Avery to Commonwealth	6	"
" Commonwealth to Fourth	4	"
" s. side, e. from Third 10 ft	4	"
" crossing Third	6	"
" n. side, e. from Third 461 ft.	4	"
" n. side, 461 ft. e. of Third to Second	6	"
" w. line of Cass to 112 ft. e. of Riopelle	4	"
" 488 ft. w. of to St. Aubin	6	"
" St. Aubin to w. line of Dubois	4	"
" crossing Dubois	8	"
" 281 ft. w. of Chene to Grandy	4	"
" 31 ft. e. of w. of Jos. Campau to 28 w. of e. of Mitchell	6	"
" Mitchell to McDougall	4	"
" e. from McDougall 281 ft.	6	"
" crossing Collins	6	"
" e. line of Collins to Detloff ct.	4	"
" Detloff ct. to alley w. of Ellery pl	6	"
" alley w. of Ellery to alley w. of Mt. Elliott	4	"
" crossing Mt. Elliott from w. to e. line	6	"
" Canton to Helen	6	"
" alley s. of, Greenwood to Leroy pl.	4	"
" alley s. of, alley e. of Riopelle to w. line of Orleans	3	"
" alley s. of, crossing w. side of Orleans	4	"
Hanover ave., crossing Russell e. side	4	"
Harmon ave., 16-in. main to e. line of Woodward	6	"
" e. line of Woodward to Oakland	4	"
Harper ave., Fifteenth to 134 ft. w. of Fourteenth.	6	"
" 134 ft. w. of to Fourteenth	4	"
" crossing Fourteenth	6	"
" 176 ft. w. of to Twelfth	4	"
" Woodward to Russell	4	"
" Widman pl. to 184 ft. e. of Dubois	4	"
" 184 ft. e. of Dubois to w. line of Chene	6	"
" w. line of Chene to 28 ft. w. of e. of Mitchell	4	"
" 28 ft. w. of e. of Mitchell to w. line of McDougall Boulevard	6	"
" crossing McDougall Boulevard	8	"
" crossing Collins	8	"
" e. line of Collins to e. line of Mt. Elliott	6	"
" Baldwin to 433 ft. e. of Van Dyke	6	"
" Rohns to Holcomb	6	"
" Gratiot to Cadillac	6	"
" alley s. of, John R. to 350 ft. e. of same	4	"
" alley s. of, crossing Brush	4	"
Harrison ave., crossing Michigan.	12	"
" Michigan to Grand River.	4	"

LOCATION.	DIAM. INCHES.	KIND.
Harrison ave., alley w. of, Linden s. to Linden n.	4	iron.
Harvey ave., Junction to 500 ft. w. of Campbell	4	"
Hastings st., s. line to 16-in. main in Jefferson	16	"
" Jefferson to Champlain	24	"
" 118 ft. s. of Congress to Fort	3	"
" Champlain to Monroe	3	"
" Congress to Clinton	6	"
" Clinton to s. line of Mullett	4	"
" crossing s. side of Mullett	8	"
" Mullett to Catherine	12	"
" Catherine to Watson	6	"
" Watson to Canfield	10	"
" Canfield to Theodore	8	"
" s. line of Farnsworth to alley s. of Palmer	6	"
" s. line of Medbury to Harper	8	"
" Harper to Piquette	6	"
" Piquette to s. line of Trombly	4	"
" s. line of Trombly to s. line of N. Boulevard	6	"
" crossing N. Boulevard	8	"
" n. line of N. Boulevard to Custer	4	"
" Custer to Marston	6	"
" first alley e. of, alley s. of to 12 ft. s. of s. line of Canfield	3	"
" first alley e. of, 12 ft. s. of s. to 21 ft. n. of s. line of Canfield	4	"
" first alley e. of, first alley s. of Garfield to Cracow pl	6	"
" second alley e. of, second alley s. of Garfield to first alley s. of same	6	"
Hazel st., Thirteenth to 96 ft. e. of same	4	"
" 96 ft. e. of Thirteenth to 156 ft. w. of Twelfth	3	"
" 156 ft. w. of Twelfth to Harrison	4	"
Hazelwood ave., e. from 10-in. main in Hamilton Boulevard 28 ft.	6	"
" 13 ft. w. of e. of Hamilton Boul. to w. line of Woodward	4	"
" w. line of Woodward to 16-in. main	6	"
Heck pl., crossing n. side of Forest	4	"
" Forest to Hancock	3	"
Hecla ave., Merrick to 343 ft. n. of Kirby	4	"
" 687 ft. s. of s. of Piquette to Milwaukee	6	"
Heidelberg st., Jos. Campau to alley e. of same	6	"
" alley e. of McDougall to w. line of Elmwood	3	"
" crossing Elmwood, w. side, 39 ft.	4	"
" Elmwood to Mt. Elliott	6	"
Helen ave., Jefferson to 91 ft. s. of s. of Macomb	6	"
" crossing Mack	6	"
" Gratiot to 192 ft. n. of Medbury	6	"
Hendricks st., St. Aubin to Dubois	3	"
" Dubois to alley w. of McDougall	4	"
" alley e. of McDougall to Elmwood	4	"
" Elmwood to 522 ft. w. of Mt. Elliott	6	"
" 522 ft. w. of to Mt. Elliott	4	"
Hendrie ave., Woodward to 550 ft. e. of John R.	4	"
" 550 ft. e. of John R. to w. line of Brush	6	"
" crossing Brush and St. Aubin	4	"
" Dubois to 224 ft. e. of same	6	"
" 224 ft. e. of Dubois to e. line of Chene	4	"
" e. from e. line of Chene 148 ft.	6	"
" 148 ft. e. of e. of Chene to e. line of Grandy	4	"
" e. line of Grandy to e. line of McDougall	6	"
Hendrie Boulevard, (both sides), crossing Collins, Ellery, Moran	6	"

LOCATION.	DIAM. INCHES.	KIND.
Hendrie Boulevard, (both sides). crossing Mt. Elliott. Meldrum, Beaufait	6	iron.
" (both sides), crossing Bellevue, Concord, Canton	6	"
" (both sides), crossing Helen	6	"
" (north side), crossing Frontenac	8	"
Hendrie ave., Baldwin to 264 ft. e. of same	6	"
" 264 ft. e. of Baldwin to Van Dyke	4	"
Henrietta ave., crossing Campbell	6	"
Henry st., alley e. of, to Third	4	"
" Third to Cass	6	"
" Clifford to Woodward	4	"
Herbert st., 134 ft. w. of Lovett to Scotten	4	"
Hibbard ave., Jefferson to 202 ft. n. of Brinket	6	"
High st, National to alley w. of Trumbull	3	"
" alley w. of Trumbull to Fourth	4	"
" Fourth to w. line of Third	3	"
" w. line of, to Third	4	"
" Third to Grand River	6	"
" Grand River to 26 ft. e. of e. of Woodward	4	"
" 27 feet e. of w. of Woodward to 3 ft. w. of e. of John R	8	"
" e. line of John R to w. line of Beaubien	4	"
" crossing Beaubien, w. to e. line	6	"
" e. line of Beaubien to 228 feet ft. e. of e	3	"
" 228 ft. e. of Beaubien to Russell	4	"
" Russell to Riopelle	3	"
Hoffman st., River st. to Fort	8	"
Holborne ave., crossing Mt. Elliott, w. side	6	"
" e. from Mt. Elliott 170 ft	4	"
Holbrook ave., Woodward to 360 ft. e. of e. line of same	6	"
Holcomb ave., Jefferson to Louis	6	"
" Goethe to Mack	6	"
" 274 ft. s. of s. of Gratiot to Harper	6	"
Holden ave., Third to Cass	10	"
" Cass to Woodward	6	"
Holden road, Third to Fourth	4	"
" Fourth to N. Boulevard, s. line	8	"
" s. line of, to 24-inch main in N. Boulevard	10	"
" Lincoln to Greenwood	4	"
Homer st., w. from Crane 215 ft	4	"
Hooker ave., e. from Grand River 63 ft	4	"
" Sullivan to 596 ft. w. of Eighteenth	6	"
" 596 ft. w. of, to Eighteenth	4	"
Horatio st., Livernois to Welch	4	"
" Welch to Howell	6	"
" Thirty-third to Thirty-second	6	"
" Scotten to La Salle	6	"
Horton ave., Woodward to Oakland	4	"
Houghton ave., Holcomb to McClellan	4	"
Howard st., Campbell to 343 ft. w. of Junction	6	"
" 343 ft. w. of, to Junction	4	"
" Scotten to alley e. of	4	"
" Twenty-fifth to Twenty-fourth	4	"
" Twenty-fourth to w. side M. C. R. R. bridge	6	"
" Twelfth to Tenth	6	"
" alley s. of, Fourteenth to alley e. of same, 190 ft	3	"
" " " 333 ft. w. of, to Tenth	4	"
" " " Tenth to First	6	"
" " " First to Shelby	4	"

LOCATION.	DIAM. INCHES.	KIND.
Howell st., alley s. of, to n. line of Buchanan	6	iron.
“ n. from Horatio 680 ft	6	“
Hubbard ave., Fort to 335 ft. n. of Brandon	6	“
“ E st. to Michigan	4	“
“ Michigan to Myrtle	6	“
Hubbard Boulevard, Myrtle to Visgar	6	“
“ (east side), Buchanan to Hancock	6	“
“ “ crossing Warren	4	“
“ “ n. line of Warren to n. line of McGraw	6	“
“ “ Scovel pl. to 161 ft. s. of N. Boulevard	6	“
“ “ 161 ft. s. of, to N. Boulevard	4	“
“ (west side), crossing Buchanan	6	“
“ “ s. line of Hancock to n. line of McGraw	6	“
“ “ s. from N. Boulevard 117 ft	6	“
“ (both sides), crossing Scovel, Moore and Wreford	6	“
Hudson ave., Vinewood to e. line of same	6	“
“ e. line of Vinewood to Twenty-sixth	4	“
“ Twenty-sixth to 25 ft. e. of w. of Twenty-third	6	“
“ Twenty-third to Maybury	4	“
“ Maybury to Grand River	6	“
“ w. line of Humboldt to 144 ft. w. of Eighteenth	4	“
“ 144 ft. west of, to Eighteenth	6	“
“ crossing e. side of Eighteenth	4	“
“ Fifteenth to Fourteenth	6	“
“ Seventh to 564 ft. w. of Greenwood	6	“
“ 564 ft. w. of, to e. line of Greenwood	4	“
“ crossing w. side of Fourth	4	“
Humboldt ave., Michigan to s. line of Butternut	4	“
“ crossing Butternut	6	“
“ n. line of Butternut to s. line of Buchanan	4	“
“ crossing Buchanan	6	“
“ n. line of Buchanan to D. & B. C. R. R.	4	“
“ s. line of Warren to McGraw	6	“
Hunt st., Dubois to alley w. of McDougall	4	“
“ alley e. of McDougall to Elmwood	4	“
“ Ellery to Mt. Elliott	4	“
Hurlbut ave., crossing Jefferson to 21 ft. n. of same	6	“
“ n. from Mack 360 feet	6	“
Huron st., s. from Locust 295 ft	3	“
“ Locust to Bagg	6	“
Hussar st., Dragoon to Military	6	“
Illinois st., Brush to Russell	6	“
“ Russell to St. Aubin	4	“
“ St. Aubin to w. line of Dubois	3	“
“ crossing Dubois	4	“
“ Dubois to Chene w. line	3	“
“ crossing Chene	4	“
“ Chene to w. line of Grandy	3	“
“ w. line of Grandy to Jos. Campau	6	“
“ e. from McDougall 241 ft	3	“
“ 241 ft. e. of to 421 ft. e. of McDougall	4	“
“ 193 ft. w. of to Moran	4	“
Indiana st., Beaubien to Russell	8	“
Ingersoll st., e. from Wesson 226 ft	4	“
Iron st., Wight to Jefferson	6	“
Irving st., Seventh to Greenwood	4	“
Ivy Place, Twenty-third to Grand River	6	“

LOCATION.	DIAM. INCHES.	KIND.
Jackson st., Thirty-fifth to Thirty-fourth	6	iron.
" Thirtieth to Twenty-ninth	6	"
" Twenty-ninth to e. line of Scotten	4	"
Jay st., Riopelle to 44 ft. w. of McDougall	4	"
Jefferson ave., First to Griswold	8	"
" Griswold to Orleans	10	"
" Dequindre to w. side of Belt Line R. R.	6	"
" e. side of Belt Line to McClellan	6	"
" McClellan to E. City Limits	10	"
" e. from E. City Limits to 178 ft. e. of e. of entrance to Driving Park grounds	8	"
" 178 ft. e. of e. of Driving Park to 27 ft. w. of e. of Marshland Road	6	"
" Second to Hastings	16	"
" Meldrum to Pumping Works	42	"
" alley s. of, Cass to Shelby	4	"
" alley s. of, alley w. of Griswold to alley w. of Woodward	4	"
" alley s. of, alley w. of Bates to Randolph.	4	"
" alley s. of, Brush to Beaubien	8	"
" alley s. of, Beaubien to 189 ft. e. of same	4	"
Joe st., Michigan to alley s. of Buchanan	6	"
John R st, Woodward to Miami	12	"
" n. side of Miami to s. side of Madison	4	"
" n. side of Madison to Adams	4	"
" Columbia to Edmund	8	"
" Edmund to s. line of Rowena	6	"
" s. line of Rowena to Brady	8	"
" Brady to s. line of Canfield	6	"
" crossing Canfield	8	"
" n. line Canfield to s. line of N. Boulevard	6	"
" crossing N. Boulevard, s. side	8	"
" Horton to Hamlin	6	"
Johnson st., Nineteenth to alley w. of Eighteenth	4	"
Jones st., Sixth to 160 ft. w. of Fifth	6	"
" 160 ft. w. of Fifth to Cass	4	"
Jos. Campau ave., Atwater to Clinton	6	"
" Jay to s. line of Gratiot	6	"
" s. line of Gratiot to St. Joseph	4	"
" St. Joseph to Trombly	6	"
" Trombly to 250 ft. n. of Milwaukee	4	"
" 250 ft. n. of Milwaukee to s. line of N. Boulevard	6	"
" crossing N. Boulevard	8	"
" N. Boulevard to 10 ft. n. of Denton (w. side)	6	"
" alley e. of, Mullett to Jay	4	"
" alley e. of, Cleveland to Hendricks	8	"
" alley e. of, Hendricks to Hunt	4	"
" alley e. of, Hunt to Charlevoix	8	"
" alley e. of Charlevoix to Heidelberg	4	"
Josephine ave., 16-in. main to e. line of Woodward	6	"
Joy st., Fifth to Fourth	4	"
" Fourth to alley e. of Third	6	"
" alley e. of Third to Cass	4	"
Julia st., Wesson to Bushey	6	"
Junction ave., River to Fort, s. line	6	"
" s. line of Fort to Otis	8	"
Kanter ave., crossing Collins	6	"
" 185 ft. w. of Collins to Moran	4	"

LOCATION.	DIAM. INCHES.	KIND.
Kanter ave., 168 ft. w. of to Mt. Elliott	4	iron.
“ crossing e. side McDougall Boulevard	6	“
Kercheval ave., Mt. Elliott to Beaufait	4	“
“ Field to Baldwin	4	“
King ave., 16-in. main to e. line Woodward	6	“
Kinsman st., Twenty-eighth to Scotten	4	“
Kirby ave., Vinewood to 247 ft. w. of Twenty-seventh	6	“
“ 247 ft. w. of to Twenty-seventh	4	“
“ crossing Humboldt	4	“
“ Eighteenth to 87 ft. e. of Sixteenth	4	“
“ 87 ft. e. of Sixteenth to 126 ft. w. of Fourteenth	6	“
“ 126 ft. w. of to Fourteenth	4	“
“ Fourteenth to Wabash	6	“
“ Thirteenth to 19 ft. e. of w. of Twelfth	6	“
“ 19 ft. e. of w. of Twelfth to 49 feet e. of w. of Trumbull	8	“
“ 49 ft. e. of w. of Trumbull to Cass	10	“
“ 23 ft. w. of e. of Cass to 18 ft. w. of e. of Rivard	16	“
“ crossing e. side of Rivard	8	“
“ e. from Russell 216 ft	4	“
“ St. Aubin to Chene	4	“
“ crossing Grandy	4	“
“ crossing Collins	6	“
“ w. line Moran to 438 e. of e. of same	6	“
“ connecting two mains in Mt. Elliott	6	“
“ Concord to Canton	6	“
“ e. from Helen 238 ft	4	“
“ Sheridan to Townsend	6	“
“ Baldwin to 161 ft. e. of same	6	“
“ 161 ft. e. of Baldwin to Van Dyke	4	“
Koch. ave., 16-inch main to e. line of Woodward	6	“
“ e. line of Woodward to w. line of Oakland	4	“
“ crossing w. side of Oakland, 26 ft	6	“
Kolb st., Crane ave. to 470 ft. e. of e. of same	6	“
Labrosse st., crossing e. side of Twelfth	6	“
“ e. line of Twelfth to 430 ft. w. of Tenth	4	“
“ 430 ft. w. of, to Tenth	3	“
“ Fifth to Fourth	4	“
“ alley s. of, alley e. of Twelfth to Fourth	4	“
Lady's lane, n. from Dry Dock st. 214 ft	4	“
Lafayette ave., Artillery to Dragoon	6	“
“ Dragoon to 123 ft. e. of same	4	“
“ 123 ft. e. of Dragoon to 315 ft. w. of Junction	6	“
“ 315 ft. w. of, to Junction	4	“
“ crossing Clark	6	“
“ e. from Scotten 256 ft	4	“
“ 256 ft. e. of, to 352 ft. e. of Scotten	6	“
“ Twenty-fourth to e. line of Twenty-third	4	“
“ Eighteenth to 110 ft. w. of w. line of Seventeenth	6	“
“ 110 ft. w. of w. of, to Seventeenth	4	“
“ alley w. of Sixteenth to Fifteenth	4	“
“ Fifteenth to w. line of Fourteenth	3	“
“ Fourteenth to Twelfth	4	“
“ crossing Twelfth, e. side	6	“
“ M. C. R. R. Bridge to 743 ft. w. of Tenth	3	“
“ 743 ft. w. of, to Tenth	4	“
“ Shelby to Griswold	4	“
“ alley s. of, Tenth to Fifth	4	“

LOCATION.	DIAM. INCHES.	KIND.
McDougall ave., alley e. of, Cleveland to s. line of Arndt	8	iron.
" alley e. of, crossing Arndt	6	"
" alley e. of, n. line of Arndt to Preston	3	"
McGraw ave., Scotten to 76 ft. e. of LaSalle	4	"
" 76 ft. e. of LaSalle to Twenty-sixth	6	"
" Twenty-sixth to Grand River	4	"
" Winslow to Sullivan	6	"
" Sullivan to Sixteenth	4	"
McGregor st., Campbell to Junction	6	"
McKinstry ave., River st. to n. line of Toledo	6	"
" Brandon to Plumer	6	"
" alley w. of, Plumer to alley s. of same	4	"
McMillan st., crossing Livernois, e. side	4	"
" Campbell to 319 ft. w. of Junction	6	"
" 319 ft. w. of, to Junction	4	"
Mack ave., Riopelle to St. Aubin	6	"
" e. from St. Aubin 300 ft	4	"
" 100 ft. w. of, to Dubois. w. line	3	"
" crossing Dubois	4	"
" e. line of Dubois to w. line of Chene	3	"
" crossing Chene	4	"
" Chene, e. line to Grandy	3	"
" Grandy to Jos. Campau	6	"
" e. from McDougall 402 ft	4	"
" Gratiot to Cadillac	42	"
" Gratiot to Mt. Elliott	4	"
" crossing Mt. Elliott, w. to e. line	6	"
" e. line of Mt. Elliott to Townsend	4	"
" Townsend to Baldwin	6	"
" Beals to 167 ft. e. of Parker	8	"
" 659 ft. w. of, to 577 ft. w. of Fischer	8	"
" 207 ft. w. of, to 65 ft. e. of Crane (s)	8	"
" McClellan to Pennsylvania	8	"
" Pennsylvania to e. line of Hamilton	6	"
" e. line of Hamilton to e. line of Park	8	"
" e. line of Park to e. line of Montclair	6	"
" w. from Helen 80 ft	6	"
Macomb st., St. Antoine to Elmwood	4	"
" alley s. of, alley w. of, to w. line of Brush	3	"
" alley s. of, w. line of Brush to St. Antoine	4	"
Madison ave., (both sides), Witherell to John R	4	"
" Randolph to 18 ft. e. of w. line of Brush	6	"
" Brush to Beaubien	8	"
" Beaubien to St. Antoine	4	"
" alley s. of, John R. to Randolph	4	"
Magnolia st., Vinewood to Twenty-seventh	4	"
" crossing Twenty-fourth	4	"
" Maybury to Sullivan	4	"
" Sullivan to w. line of Humboldt	3	"
" crossing Humboldt	4	"
" e. line of Humboldt to Eighteenth	3	"
" Fifteenth to Fourteenth	4	"
" Wabash to Thirteenth	3	"
" Thirteenth to Harrison	4	"
Mansur st., Harper to 78 ft. s. of Piquette	4	"
Maple st., Gratiot to Orleans	8	"
" Orleans to St. Aubin	4	"

LOCATION.	DIAM. INCHES.	KIND.
Maple st., St. Aubin to w. line of Dubois	3	iron.
" crossing Dubois	8	"
" Dubois to Elmwood	3	"
Marcy st., Greenwood to 158 ft. w. of Fourth	4	"
" 158 ft. w. of to Fourth	8	"
Marietta st., e. from McClellan 521 ft	4	"
" 521 ft. e. of e. of McClellan to 109 w. of w. of Pennsylvania	6	"
Mark st., Thirteenth to 176 ft. w. of Twelfth	6	"
" 176 ft. w. of to Twelfth	4	"
Marston ct., 16-in. main in Woodward to 124 ft. w. of w. of John R	6	"
" Oakland to Hastings	6	"
Martin pl., 10-in. main in Woodward to 20 ft. w. of e. of John R	8	"
Maybury ave., Michigan to n. line of Ash	6	"
" n. line of Ash to 173 ft. n. of Warren	8	"
" s. from Hudson 256 ft	8	"
Mechanic st., Brush to Beaubien	4	"
Medbury ave., Woodward to 364 ft. e. of e. of John R	4	"
" 364 ft. e. of e. of John R to 460 ft. e. of e. of same	3	"
" 22 ft. w. of e. of Brush to 128 ft. e. of e. of same	3	"
" 223 ft. w. of w. of St. Antoine to 149 ft. e. of e. of same	3	"
" 140 ft. w. of w. of Hastings to 168 ft. e. of e. of same	3	"
" 194 ft. w. of w. of Rivard to 22 ft. w. of e. of same	3	"
" 22 ft. w. of e. of Rivard to e. line of same	4	"
" 730 ft. w. of to w. line of St. Aubin	3	"
" w. line of St. Aubin to Jos. Campau	4	"
" Mitchell to e. line of Collins	6	"
" 533 ft. w. of to 168 ft. e. of Mt. Elliott	6	"
" Canton to Helen	6	"
" Helen to Frontenac	4	"
" Baldwin to Van Dyke	6	"
" alley s. of John R to 350 ft. e. of same	4	"
" alley s., crossing Brush	6	"
Melbourne ave., crossing e. side of Woodward ave	6	"
Meldrum ave., Wight to Jefferson	10	"
" Jefferson to 46 ft. n. of Fort	6	"
" 46 ft. n. of Fort to 360 ft. n. of Kercheval	4	"
" 360 ft. n. of, to 642 ft. n. of Kercheval	6	"
" Arndt to Gratiot	6	"
" crossing N. Boulevard	6	"
" Jefferson to Congress	42	"
Merrick ave., Vinewood to Twenty-seventh	4	"
" Twenty-third to Tillman	4	"
" Tillman to Williams	6	"
" w. line of Wabash to Twelfth	6	"
" 132 ft. w. of, to Seventeenth	4	"
" Twelfth to 35 ft. w. of e. of Avery (s)	4	"
" 35 ft. w. of e. of Avery(s.) to 26 ft. e. of w. of Avery(n.) 99 ft.	6	"
" 26 ft. e. of w. of Avery (n.) to Trumbull	4	"
" Lincoln to e. line of Greenwood	4	"
" e. line of Greenwood to 136 ft. w. of Fourth	3	"
" 136 ft. w. of to Fourth	4	"
" Third to 26 ft. e. of w. of Second	4	"
" 26 ft. e. of w. of Second to 21 ft. w. of e. of same	6	"
" 21 ft. w. of e. of Second to Cass	4	"
" alley s. of, crossing e. side of Greenwood	4	"
" alley s. of, e. line of Greenwood to alley w. of Fourth	3	"
Miami ave., Gratiot to Witherell	16	"

LOCATION.	DIAM. INCHES.	KIND.
Miami ave., n. side of John R to Witherell	4	iron.
" alley w. of, alley s. of, to Gratiot	6	"
" alley w. of ,Gratiot to 80 ft. s. of Witherell	4	"
" alley e. of, Randolph to John R.	4	"
Michigan ave., crossing W. Boulevard (s. side)	6	"
" Livernois to Twenty-fourth	6	"
" Twenty-fovrth to Foundry.	8	"
" Vinewood to Tenth	24	"
" Tenth to First	8	"
" First to Washington	10	"
" Cass to Woodward	24	"
" alley s. of, Cass to Shelby	4	"
" private alley s. of, Shelby to 110 ft. e. of same	3	"
Middle st., alley s. of Grand River to 230 ft. e. of Clifford	4	"
Military ave., River st. to 250 ft. n. of Wabash R. R	6	"
" 62 ft. n. of Anthon to Toledo	6	"
Miller st., crossing Seventh	4	"
" Seventh to Sixth	3	"
Milwaukee ave., 36 ft. w. of Sullivan to e. line of Eighteenth	4	"
" crossing Fourteenth	6	"
" Twelfth to w. line of Avery	6	"
" Lincoln to Beaubien	6	"
" Beaubien to w. line of Riopelle	4	"
" w. line of Riopelle to Dubois	6	"
" Dubois to Chene	4	"
" Craig to w. line of Collins	6	"
" crossing Collins	8	"
" crossing Mt. Elliott w. line to 2 ft. w. of e	6	"
Miner ave., e. from Crane 336 ft.	4	"
" 336 ft. e. of Crane to Holcomb	6	"
Minnie ave., 23 ft. n. of River st. to 582 ft. s. of Fort	6	iron.
" 582 ft. s. of to Fort	4	"
Mitchell ave., n. from Gratiot 265 ft	6	"
" 265 ft. n of Gratiot to Canfield	4	"
" Canfield to Harper	6	"
" n. from Harper 324 ft	4	"
" 324 ft. n. of Harper to Trombly	6	"
" Trombly to Griffin	4	"
" crossing s. side of N. Boulevard	8	"
Mohawk st., crossing Vinewood e. side	4	"
Monroe ave., Cadillac square to Randolph	12	"
" Randolph to St. Antoine	8	"
" St. Antoine to Elmwood	4	"
" 90 ft. n. of Cadillac square to Farmer	3	"
" 216 ft. w. of to 171 ft. e. of Leib	4	"
" w. from Helen 185 ft.	4	"
" alley s. of, alley n. of Cadillac square to Randolph	4	"
" alley s. of, Brush to St. Antoine	4	"
Montcalm st., Cass to 412 ft. w. of Woodward	3	"
" 412 ft. w. of to Woodward	4	"
" alley e. of Woodward to Brush	4	"
" Brush to w. line of Beaubien	3	"
" crossing w. to e. of Beaubien	6	"
" e. line of, Beaubien to St. Antoine	3	"
" St. Antoine to Hastings	6	"
" Hastings to Russell	3	"
" alley s. of, 240 ft. w. of to Beaubien	4	"

LOCATION.	DIAM. INCHES.	KIND.
Montclair ave., n. from Mack 852 ft.	6	iron.
Monteith st., Vinewood to Twenty-seventh	6	"
Moore pl., crossing Hubbard Boulevard	6	"
Moran st., Gratiot to Dane	6	"
Morrell st., River st. to 87 ft. n. of n. of Christiancy	6	"
" 348 ft. s. of Dix to Toledo	6	"
" alley w. of, 21 ft. n. of s. of Brandon to 4 ft. n. of s. of alley s. of Plumer	6	"
Mott ave., 16-in. main to e. line of Woodward	6	"
" e. from Woodward 558 ft.	4	"
Mt. Elliott ave., 148 ft. s. of Wight to 285 ft. s. of Kercheval	6	"
" 285 ft. s. of Kercheval to Preston	8	"
" Preston to Mack	10	"
" Mack to Gratiot	8	"
" Gratiot to s. line of Hendrie Boulevard, (e. side)	4	"
" crossing Boulevard	8	"
" n. line of Boulevard to 300 ft. n. of Griffin	4	"
" 300 ft. n. of Griffin to Forest Lawn Cemetery	6	"
" Gratiot to Warren (w. side)	6	"
" Harper to 182 ft. s. of (e. side).	6	"
Mullett st., Gratiot to Chene	30	"
" St. Antoine to Elmwood	4	"
Mulberry st., Thirteenth to Twelfth	4	"
Myrtle st., Hubbard to Grand River	6	"
Nall ave., crossing Vinewood	6	"
Napoleon st., Brush to w. line of Beaubien	4	"
" crossing Beaubien	6	"
" e. line of Beaubien to Russell	4	"
National ave., Michigan to Grand River	6	"
Navarre st., McClellan to 425 ft. e. of e	6	"
Newark st., Twentieth to Nineteenth	6	"
Newberry ave.. Cavalry to 341 ft w. of Junction	6	"
" 341 ft. w. of to Junction	4	"
Newton ave , w. from Jos. Campau 1,264 ft.	4	"
Nineteenth st., Fort to Baker	4	"
" Baker to Newark	6	"
" alley w. of, 197 ft. s. of to Rose.	3	"
Noble st., Seventh to Sixth	4	"
" Greenwood to 150 ft. w. of Fourth	4	"
" 150 ft. w. of to Fourth	8	"
Norton st., 283 ft. e. of to Wesson.	4	"
" Thirty-first to 386 ft. e. of Junction	6	"
" 386 ft. e. of to Junction	4	iron.
Oakland ave., Piquette to Trombly	6	"
" Milwaukee to s. line of Boulevard	4	"
" s. line of N. Boulevard to 24-in. main 87 ft.	6	"
" 24-in. main in N. Boulevard to 27 ft. n. of s. of Horton	10	"
" Horton to Hamlin	6	"
" Hamlin to Sidney	10	"
" Belmont to Harmon	10	"
" Harmon to 130 ft. n. of Woodland	8	"
Orchard st., Trumbull to Sixth	6	"
" Sixth to w. side of Elton park	4	"
" e. side of Elton park to First	4	"
Orleans st., Atwater to Jefferson	10	"
" Jefferson to 100 ft. n. of n. of Wilkins	8	"
" Congress to 75 ft. n. of n. of Wilkins	24	"

LOCATION.	DIAM. INCHES.	KIND.
Orleans st., crossing Leland s. side	6	iron.
" Alexandrine to s. line of Canfield	6	"
" crossing s. side of Canfield 30 ft	30	"
" Garfield to 252 ft. n. of	4	"
" 252 ft. n. of Garfield to 195 ft. n. of Forest	6	"
" Trombly to Lyman	4	"
Ottawa st., e. from Thirteenth 130 ft	3	"
Otis st., e. from Junction 300 ft	4	"
" 300 ft. e. of Junction to alley w. of Thirty-first	6	"
Owen ave., 16-in. main in Woodward to 1,220 ft. e. of Woodward	6	"
Pallister ave., 260 ft w. of to Hamilton Boulevard	6	"
" crossing w. side of Woodward	6	"
Palmer ave., Woodward to 254 ft. w. of w. of Brush	4	"
" 254 ft. w. of to w. line of Brush	6	"
" crossing w. side of Brush	4	"
" crossing e. side of Brush	6	"
" crossing Beaubien and St. Antoine, n. and s. sides	4	"
" crossing Russell and St. Aubin	4	"
" e. line of St. Aubin to 129 ft. w. of Dubois	6	"
" 129 ft. w. of Dubois to e. line of Grandy	4	"
" Mitchell to McDougall	6	"
" crossing w. side of Moran	6	"
" 20 ft. e. of w. of Moran to 190 ft. e. of same	4	"
" 4 ft. e. of w. of Mt. Elliott to 159 ft. e. of Meldrum	6	"
" Townsend to 235 ft. e. of Baldwin	6	"
" 235 ft. e. of Baldwin to Van Dyke	4	"
" alley s. of (or Private st. s. of Ferry) 362 ft. w. of to Rivard	3	"
" alley s. of (or Private st. s. of Ferry) crossing e. side of Rivard	4	"
Park ave., Dix to Toledo	6	"
" (east of city limits), Mack to 568 ft. n. of Canfield	6	"
Park pl. East, Michigan to s. line of State	4	"
" crossing State	6	"
Park st., Woodward to Columbia	16	"
" Henry to Peterboro	4	"
" Woodward to Washington	6	"
Parker ave., Tonti to 250 ft. n. of Coe	6	"
" 842 ft. s. of, to 534 ft. n. of Mack	6	"
Parkman ave., 473 ft. w. of Seventh to Hamilton Boulevard	4	"
" w. line of Woodward to 16-inch main	6	"
Parsons st., Cass to Woodward	4	"
Pennsylvania ave., Jefferson to 1,410 ft. n. of n. of same	6	"
" 145 ft. s. of Mack to 50 ft. n. of Elsa	6	"
Perry st., Humboldt to Eighteenth	4	"
" Harrison to Twelfth	6	"
" National to alley w. of Trumbull	4	"
" alley e. of Trumbull to Grand River	4	"
" alley s. of, alley w. of Eighth to alley w. of Sixth	4	"
Peterboro st., Cass to Woodward	4	"
Philadelphia ave., e. from Russell 389 ft	4	"
Pierce st., Dequindre to Jos. Campau	4	"
Pine st., crossing e. side of Twelfth	4	"
" e. line of Twelfth to National	3	"
" National to Grand River	4	"
Pitcher st., Seventh to Sixth	4	"
" Greenwood to 150 ft. w. of Fourth	4	"
" 150 ft. w. of, to Fourth	3	"
" alley e. of Third to Cass	4	"

LOCATION.	DIAM. INCHES.	KIND.
Pingree ave., Hamilton Boulevard to Woodward	6	iron.
Piquette ave., Sullivan to Eighteenth	4	"
" Fourteenth to e. line of same	6	"
" e. line of Fourteenth to Wabash	4	"
" Twelfth, crossing e. side	6	"
" e. line of Twelfth to w. line of Avery	4	"
" Lincoln to Trumbull	6	"
" Greenwood to 124 ft. e. of e. of Fifth	6	"
" Woodward to Beaubien	4	"
" Beaubien to Russell	6	"
" Dubois to 186 ft. e. of e. line of same	6	"
" 186 ft. e. of e. of Dubois to Chene, e. line	4	"
" e. line of Chene to Grandy	6	"
" Mitchell to 32 ft. e. of e. of McDougall Boulevard	6	"
" 32 ft. e. of e. of Boulevard to Collins, w. line	4	"
" w. line of Collins to 326 ft. w. of Mt. Elliott	6	"
" 326 ft. w. of, to Mt. Elliott	4	"
Pleasant ave., n. from River st. 515 ft	4	"
Plum st., Trumbull to alley e. of	6	"
" alley e. of Trumbull to Second	4	"
Plumer st., Livernois to Welch	4	"
" Wesson to 283 ft. w. of Junction	6	"
" 283 ft. w. of Junction to w. line of McKinstry	4	"
" crosing w. side of McKinstry	6	"
" alley s. of, alley w. of Morrell to 614 ft. w. of alley w. of McKinstry	6	"
" alley s. of, 614 ft. w. of, to alley w. of McKinstry	4	"
Pollard st., 1,242 ft.w. of, to Jos. Campau	4	"
Poplar st., Twenty-fourth to 184 ft. w. of Twenty-third	6	"
" 184 ft. w. of Twenty-third to Tillman	4	"
" Maybury to 376 ft. e. of same	4	"
" 51 ft. w. of Sullivan to alley w. of Humboldt	6	"
" w. line of Fifteenth to 110 ft. e. of Wabash	4	"
" 110 ft. e. of e. of Wabash to Thirteenth	6	"
Porter st., crossing Campbell	6	"
" Ferdinand to McKinstry	4	"
" Scotten to w. line of Hubbard	3	"
" crossing Hubbard, w. side	4	"
" Vinewood to e. line of W. Boulevard	6	"
" e. line of W. Boulevard to Twenty-second	4	"
" Twenty-second to 150 ft. w. of Twenty-first	3	"
" 150 ft. w. of, to Twenty-first	4	"
" Twenty-first to Twentieth	3	"
" Nineteenth to Eighteenth	4	"
" crossing Fourteenth	4	"
" e. from Fourteenth 172 ft	3	"
" Thirteenth to 210 ft. w. of Twelfth	4	"
" 210 ft. w. of to Twelfth	3	"
" Fourteenth to Tenth	12	"
" alley s. of, Thirteenth to alley e. of same	3	"
" alley s. of, Twelfth to First	4	"
Prentiss ave., Greenwood to alley w. of Fourth	4	"
" Third to Cass	4	"
Preston st., McDougall to Mt. Elliott	4	"
Private way (e. of Russell), s. from Clay 405 ft	4	"
Pulford ave., Gratiot to Mt. Elliott	4	"
" Meldrum to Beaufait	4	"

LOCATION.	DIAM. INCHES.	KIND.
Putnam ave., Fourteenth to Wabash	4	iron.
“ w. line of Thirteenth to 185 ft. w. of Twelfth	4	“
“ 185 ft. w. of to Twelfth	8	“
“ Twelfth to Trumbull	4	“
“ Lincoln to Fourth	4	“
“ Third to 323 ft. e. of same	4	“
“ 323 ft. e. of Third to alley w. of Second	6	“
“ w. line of Cass to 60 ft. w. of Woodward	4	“
“ 60 ft. w. of to Woodward	6	“
Railway ave., Scotten to LaSalle	6	“
Randall st., crossing w. side of Twenty-third, 26 ft	4	“
Randolph st., alley s. of Atwater to Jefferson	4	“
“ Atwater to 24-in. main in Cadillac square	8	“
“ Larned to Congress	4	“
“ Congress to s. line of Gratiot	6	“
“ crossing Gratiot	10	“
“ Gratiot to Adams	6	“
“ alley e. of, alley s. of Fort to Champlain	4	“
“ alley e. of, alley s. of Macomb to Gratiot	4	“
Ranspach st., Livernois to Hammond	4	“
Raynor st., Clinton to Gratiot	4	“
Reed pl., 335 ft. w. of to Greenwood	4	“
“ Greenwood to 36 feet w. of Fourth	3	“
“ 36 ft. w. of to Fourth	4	“
Reeder ave., 438 ft. w. of Campbell to Junction	4	“
Regular ave., Military to Cavalry	6	“
Reservoir grounds, n. of basin to 30-in. branch	24	“
“ s. and w. sides of basin	24	“
Rich st., Twenty-eighth to Clark	6	“
“ Clark to Scotten	4	“
“ Vinewood to 204 ft. e. of same	4	“
“ 204 ft. e. of Vinewood to Twenty-seventh	6	“
Riopelle st., Atwater to Jefferson	8	“
“ Jefferson to Larned	12	“
“ Larned to Adelaide	8	“
“ Adelaide to 218 ft. n. of Hancock	6	“
“ Frederick to Kirby	6	“
“ alley e. of, Willis to Canfield	4	“
“ alley e. of, Garfield to 233 ft. n. of same	4	“
“ alley e. of, 233 ft. n. of Garfield to alley s. of Hancock	6	“
Rivard st., Atwater to Jefferson	8	“
“ Jefferson to Clinton	10	“
“ Clinton to 9 ft. s. of Mullett	6	“
“ Mullett to Gratiot	10	“
“ Gratiot to Watson	4	“
“ Eliot to 90 ft. s. of Warren	4	“
“ 90 ft. s. of Warren to 21 ft. n of s. of Farnsworth	6	“
“ 1 ft. n. of s. of Farnsworth to 36 ft. n. of s. of Kirby	16	“
“ Kirby to 221 ft. n. of Palmer	4	“
“ 221 ft. n. of Palmer to Harper	6	“
“ crossing Piquette	4	“
“ 5 ft. s. of to 153 ft. n. of N. Boulevard	6	“
“ 153 ft. n. of N. Boulevard to Clay	4	“
“ n. from Clay 1,178 ft	6	“
“ Larned to Congress	4	“
River st., main entrance of Exposition Grounds to Campau	6	“
“ Campau to Pleasant	8	“

LOCATION.	DIAM. INCHES.	KIND.
River st., 525 ft. w. of Twenty-fourth to w. side of M. C. R. R. tracks	8	iron.
" crossing M. C. R. R. from w. to e. side 270 ft	6	"
" e. side M. C. R. R tracks to Sixth st	8	"
" Sixth to Fifth and Fourth to Third	4	"
" alley s. of, Third to Second	4	"
Roby st., n. from Ferry 325 ft	4	"
Rohns ave., Goethe to 1,283 ft n. of n. of Mack	6	"
" 360 ft. s. of Chapin to 800 ft. s. of Gratiot	8	"
" 800 ft. s. of Gratiot to Harper	6	"
Romeyn st., Campbell to Junction	4	"
Rose st., Twentieth to Eighteenth	4	"
Rosedale ave., 16-in. main to e. line of Woodward	6	"
" e. line of Woodward to w. line of Oakland	4	"
" w. line of to Oakland	6	"
Rowena st., Woodward to 23 ft. e. of w. of John R	4	"
" 23 ft. e. of w. of John R to 23 ft. e. of w. of Brush	8	"
" 23 ft. e. of w. of Brush to Riopelle	4	"
Rowland st., 24-in. main in Michigan to Grand River	8	"
Russell st., Larned to n. line of Congress	6	"
" Congress to Macomb	8	"
" Mullett to Watson	8	"
" Watson to Canfield	6	"
" Canfield to s. line of Hendrie	10	"
" s. line of Hendrie to s. line of Piquette	8	"
" s. line of Piquette to Alger	6	"
" alley e. of, Chase to Fort	4	"
" alley e. of Willis to 220 ft. n. of same	4	"
St. Albertus pl., 22 ft. e. of Dequindre to 260 ft. w. of St. Aubin	4	"
" 260 w. of, to St. Aubin	3	"
St. Antoine st., Atwater to Congress	8	"
" Congress to s. line of Champlain	6	"
" crossing Champlain	8	"
" n. line of Champlain to n. line of Gratiot	6	"
" Jefferson to Congress	4	"
" Catherine to Elizabeth	12	"
" Elizabeth to Adelaide	6	"
" Adelaide to Watson	8	"
" Watson to n. line of Farnsworth	6	"
" crossing Frederick and Palmer	6	"
" s. line of Medbury to s. line of N. Boulevard	6	"
" crossing North Boulevard, s. side to 24-inch. main	8	"
" alley e. of, North Boulevard to Custer	3 & 4	"
St. Aubin ave., Atwater to 22 ft. n. of n. of Harper	6	"
" 22 ft. n. of n. of Harper to Trombly	8	"
" Trombly to n. line of Boulevard	10	"
" Clay to 22 ft. n. of Danforth	6	"
" Larned to Congress	12	"
" Congress to Champlain	36	"
" alley e. of, Kirby to Palmer	4	"
St. Clair pl., Nineteenth to alley w. of Eighteenth	4	"
St. Joseph st., Russell to Riopelle	3	"
" e. line of Riopelle to 310 ft. e. of St. Aubin	4	"
" 310 ft. e. of St. Aubin to w. line of Chene	3	"
" crossing Chene	4	"
" e. line of Chene to 202 ft. e. of same	3	"
" 202 ft. e. of Chene to Grandy, w line	4	"
w. line of Grandy to 18 ft. e. of w. of Jos. Campau	6	"

LOCATION.	DIAM. INCHES.	KIND.
St. Joseph st., w. line of McDougall to 438 ft. e. of same	3 & 4	iron.
St. Paul ave., Bellevue to e. line of Concord	4	"
" crossing Frontenac Boulevard	6	"
" e. line of Frontenac Boulevard to e. line of Field	4	"
" Townsend to Baldwin	4	"
" Crane to alley w. of same	4	"
" Holcomb to Belvidere	6	"
Sargent st., St. Aubin to 6 ft. e. of D., G. H. & M. R. R.	8	"
" crossing Collins	6	"
Savoy st., Twenty-fourth to Twenty-third	4	"
" Twenty-second to Twenty-first	4	"
Schiller st., e. from McClelian 245 ft	4	"
Schiller Boulevard, (n. and s. sides), at w. line of Woodward 8 ft	4	"
Schneider pl., e. from Ellery 105 ft	6	"
" 105 ft. e. of Ellery to Mt. Elliott	4	"
Scott st., Riopelle to e. line of St. Aubin	4	"
" e. line of St. Aubin to Dubois	3	"
" crossing Dubois to 156 ft. e. of same	4	"
" 156 ft. e. of Dubois to 499 ft. e. of Chene	8	"
" 499 ft. e. of Chene to Jos. Campau	4	"
" Orleans to Chene	30	"
Scotten ave., Fort to Dix	6	"
" Dix to Buchanan, (s.)	8	"
" Buchanan(s.) to Buchanan (n.)	16	"
" Buchanan to McGraw	6	"
Scovel pl., crossing W. Boulevard to 24 ft. e. of same	6	"
" in Mound "Eckstrom" 50 ft	4	"
Sears ave., Holcomb to 193 ft. e. of McClellan	4	"
Second st., Front to Woodbridge	6	"
" Woodbridge to alley n. of Jefferson	10	"
" crossing Congress	10	"
" Abbott to alley s. of same	8	"
" Abbott to Grand River	10	"
" alley w. of, Front to alley n. of same	4	"
" " alley s. of to Lewis	4	"
Second ave., High to 166 ft. n. of Henry	4	"
" Grand River to Bagg	10	"
" Bagg to s. line of Canfield	6	"
" crossing Canfield, s. line to 20 ft. s. of n	8	"
" 20 ft. s. of n. to 30 ft. n. of Prentiss	6	"
" (e. side) 16 s. of n. of Forest to 17 ft. s. of n. of Hancock	6	"
" crossing Forest, s. line to 22 n. of n. line	6	"
" (e. side) crossing Putnam and Merrick	6	"
" (w. side) crossing Putnam and Merrick	4	"
" 36 ft. s. of n. of Kirby to 2 ft. n. of n. of Colburn	6	"
" 24 ft. s. of n, of Colburn to s. line of N. Boulevard	6	"
" crossing North Boulevard	8	"
" alley w. of, Forest to Putnam	6	"
Secor pl., s. from Ferry to 267 ft. s. of s	4	"
Selden ave., Seventh to Sixth st	4	"
" crossing Greenwood	4	"
" Greenwood to alley w. of Fourth	3	"
" alley w. of to Fourth	4	"
" Third to Woodward	4	"
" alley s. of Greenwood to alley n. of Fourth	4	"
Seventh st., River st. to alley n. of Lafayette	8	"
" alley n. of Lafayette to Bagg	10	"

LOCATION.	DIAM. INCHES.	KIND.
Seventh st., Bagg to Grand River	8	iron.
" Grand River to Calumet	6	"
" crossing Calumet s. to n. line	8	"
" n. line of Calumet to 684 ft. n. of Stanley	6	"
" alley w. of, alley s. of, to Spruce	3	"
" alley w. of, alley s. of to Perry	4	"
Seventeenth st., Fort to 28 ft. s. of Poplar	6	"
" 28 ft. s. of Poplar to s. line of Buchanan	4	"
" s. line of Buchanan to Warren	6	"
Seward ave., 184 ft. w. of Hamilton Boulevard to Woodward	6	"
Seyburn ave., Jefferson to n. line of Agnes	6	"
" 462 ft. s. of, to Gratiot	6	"
Shady lane, crossing W. Boulevard	4	"
" crossing Vinewood	6	"
Shakespeare Boulevard, n. and s. sides, at w. line of Woodward ave. 9 ft.	4	"
Shelby st., Atwater to Woodbridge	6	"
" Woodbridge, crossing n. side	8	"
" n. line of Woodbridge to Michigan	10	"
" Lafayette to alley s. of Michigan	4	"
Sheridan ave., Jefferson to 35 ft. s. of n. of Waterloo	6	"
" Mack to Gratiot	6	"
" Gratiot to 18 ft. n. of Ferry	8	"
Sherman st., Hastings to Elmwood	4	"
" Russell to Orleans	8	"
Shipherd ave., Champlain to 221 ft. n. of n.	6	"
" n. from Florene 169 ft.	6	"
Sibley st., Clifford to Woodward	4	"
Sidney ave., 16-inch main in Woodward to Oakland	6	"
" Russell to 779 ft. e. of	4	"
Sixth st., River st. to Congress	16	"
" Congress to Abbott	24	"
" River st. to alley n. of	4	"
" Abbott to Cherry	6	"
" Cherry to 47 ft. s. of Bagg	12	"
" 47 ft. s. of Bagg to 24-in. main	16	"
" n. from Bagg to Grand River	8	"
" Grand River to 473 ft. n. of	4	"
" 473 ft. n. of Grand River to Calumet	6	"
" crossing Calumet	8	"
" n. line of, to 20 ft. n. of Calumet	6	"
" 20 ft. n. of n. of Calumet to 265 ft. n. of Lysander	4	"
Sixteenth st., Lafayette to Myrtle	6	"
" Myrtle to Buchanan	8	"
" Buchanan to Grand River	10	"
" Grand River to McGraw	8	"
" s. from 24-inch main in N. Boulevard 63 ft.	8	"
" alley w. of, Lafayette to Howard	3	"
Smith ave., Woodward to 3 ft. w. of w. of Oakland	4	"
" 3 ft. w. of w., to 25 ft. e. of w. of Oakland	6	"
South st., Grand River to Noble	4	"
Southern ave, Livernois to 152 ft. e. of same	4	"
Spencer st., Second to Cass	4	"
" alley s. of, alley w. of to First	4	"
Sproat st., Cass to Woodward	4	"
Spruce st., Thirteenth to Twelfth	6	"
" Twelfth to Harrison	4	"
" National to alley w. of Trumbull	4	"

LOCATION.	DIAM. INCHES.	KIND.
Spruce st., alley w. of to Seventh	3	Iron.
“ Seventh to Fifth	4	“
“ alley s. from Second, alley w. of to first alley w. of Seventh	3	“
Standish st., Twentieth to Foundry	6	“
Stanley ave., Tillman to Williams	6	“
“ Grand River to Sullivan	6	“
“ crossing Humboldt and Eighteenth	4	“
“ Stanton to Sixteenth	6	“
“ crossing Fourteenth	6	“
“ 183 ft. w. of to Twelfth	4	“
“ Commonwealth to Seventh	4	“
“ Seventh to Greenwood	6	“
Stanton ave., Merrick, to Antoinette	6	“
“ crossing N. Boulevard	6	“
Stark ave., Livernois to Welch	4	“
State st., Cass to Woodward	10	“
“ crossing Washington, e. side, 24 ft.	24	“
“ 80 ft. w. of e. of Washington to Woodward	30	“
“ alley s. of, from alley w. of to First	4	“
“ alley s. of, from alley w. of Cass to Washington	4	“
Stimson pl., Cass to Woodward	4	“
Stuart st., Bellevue to Canton	6	“
Sullivan ave., Michigan to Buchanan	6	“
“ crossing Warren	6	“
“ 25 ft. s. of n. of Stanley to Baltimore	6	“
“ crossing N. Boulevard	8	“
Summit ave., River st. to Fort	6	“
Superior st., crossing Brush	4	“
“ 3 ft. e. of e. of Brush to 220 ft. w. of Beaubien	6	“
“ 220 ft. w. of to Beaubien	4	“
“ Beaubien to Russell	6	“
“ Riopelle to Dequindre	4	“
“ Dequindre to St. Aubin	6	“
“ crossing e. side of St Aubin	4	“
“ St. Aubin to w. line of Chene	3	“
“ crossing Chene	4	“
“ e. line of to 343 ft. e. of Chene	3	“
“ 343 ft. e. of Chene to Mitchell	4	“
“ McDougall to Gratiot	4	“
Swain ave., 40 ft. s. of Wabash R. R. to Fort	6	“
Sycamore st., Wabash to Harrison	4	“
“ National to alley w. of Trumbull	4	“
“ 123 ft. w. of to Grand River	6	“
Sylvan st., Vinewood to 65 ft. e. of same	4	“
“ 65 ft. e. of Vinewood to 105 ft. w. of Twenty-seventh	6	“
“ 105 ft. w. of to Twenty-seventh	4	“
Sylvester st., Gratiot to Mt. Elliott	4	“
“ Beaufait to Concord	4	“
Taylor ave., crossing Hamilton Boulevard	6	“
Tenth st., River st. to Abbott	8	“
“ Abbott to Michigan	24	“
Theodore st., John R. to 106 ft. e. of Riopelle	4	“
“ 268 ft. w. of St. Aubin to w. line of Dubois	4	“
“ crossing Dubois	6	“
“ e. line of Dubois to Grandy	4	“
“ 11 e. of w. of Jos. Campau to 27 ft. w. of e. of McDougall	6	“
“ crossing Collins	6	“

LOCATION.	DIAM. INCHES.	KIND.
Theodore st., crossing Moran w. side	6	iron.
" e. from Moran 375 ft.	4	"
" crossing Mt. Elliott main to main	6	"
" 15 ft. w. of e. of Mt. Elliott to w. line of Beaufait	4	"
" Helen to 191 ft. e. of same	6	"
" alley s. of, e. and w. of Davis pl. 150 ft.	4	"
Third st., Front to s. line of River st.	6	"
" s. line of River to Larned	8	"
" Larned to alley n. of	6	"
" Larned to Fort st.	24	"
" Abbott to High	6	"
Third ave., Grand River to Bagg	8	"
" Bagg to Calumet, s. line	6	"
" s. to n. line of Calumet	8	"
" n. line of Calumet to Holden, n. line	6	"
" crossing Baltimore	6	"
" Calumet to Canfield	30	"
Thirteenth st., River st. to Fort	4	"
" Fort to Howard	6	"
" Porter to Ash	6	"
" crossing Myrtle	6	"
" Magnolia to n. line of Grand River	6	"
" n. line of Grand River to 15 ft. n. of Canfield	4	"
" 15 ft n. of Canfield to Hancock	6	"
" Hancock to 150 ft. n. of	4	"
" 150 ft. n. of Hancock to 20 ft. n of s. of Kirby	6	"
" alley w. of, Bagg to Myrtle	6	"
Thirtieth st., 30 feet s. of Jackson to Buchanan	6	"
" Devereaux to 153 ft. s. of Warren	6	"
Thirty-first st., Michigan to 250 ft. s. of Warren	6	"
" 150 ft. s. of, to Norton	6	"
Thirty-second st., Michigan to 15 ft. s. of Buchanan	4	"
" 15 ft. s. of, to 85 ft. n. of Buchanan	6	"
" 85 ft. n. of, to 385 ft. n. of Buchanan	8	"
" 385 ft. n. of Buchanan to 82 ft. n. of Horatio	6	"
Thirty-third st., Michigan to Horatio	6	"
Thirty-fourth st., Michigan to 136 ft. n. of Jackson	8	"
" 64 ft. s. of, to 132 ft. n. of Buchanan	8	"
" 132 ft. n. of Buchanan to 126 ft. n. of Rich	6	"
Thirty-fifth st., Michigan to n. line of Buchanan	6	"
" n. line of Buchanan to 277 ft. n. of n. of Rich	8	"
Thompson ct., n. of Forest 115 ft.	4	"
Tillman ave., Michigan to 360 ft. n. of Merrick	6	"
" Hudson to McGraw	6	"
Toledo ave., Livernois to McKinstry	6	"
" McKinstry to 360 ft. e. of Scotten	4	"
" 360 ft. e. of Scotten to Hubbard	6	"
" w. line of W. Boulevard to Twenty-fifth	6	"
Tonti st., Van Dyke to Parker	6	"
Torrey st., Twenty-eighth to Lovett	4	"
" crossing w. side of Scotten	4	"
Townsend ave., Jefferson to 36 ft. n. of s. of Waterloo	6	"
" n. from Mack 208 ft.	6	"
" 208 ft. n. of Mack to s. line of Gratiot	4	"
" s. line of to 8-in. main in Gratiot	8	"
" 8-in. main in Gratiot to n. line of Palmer	6	"

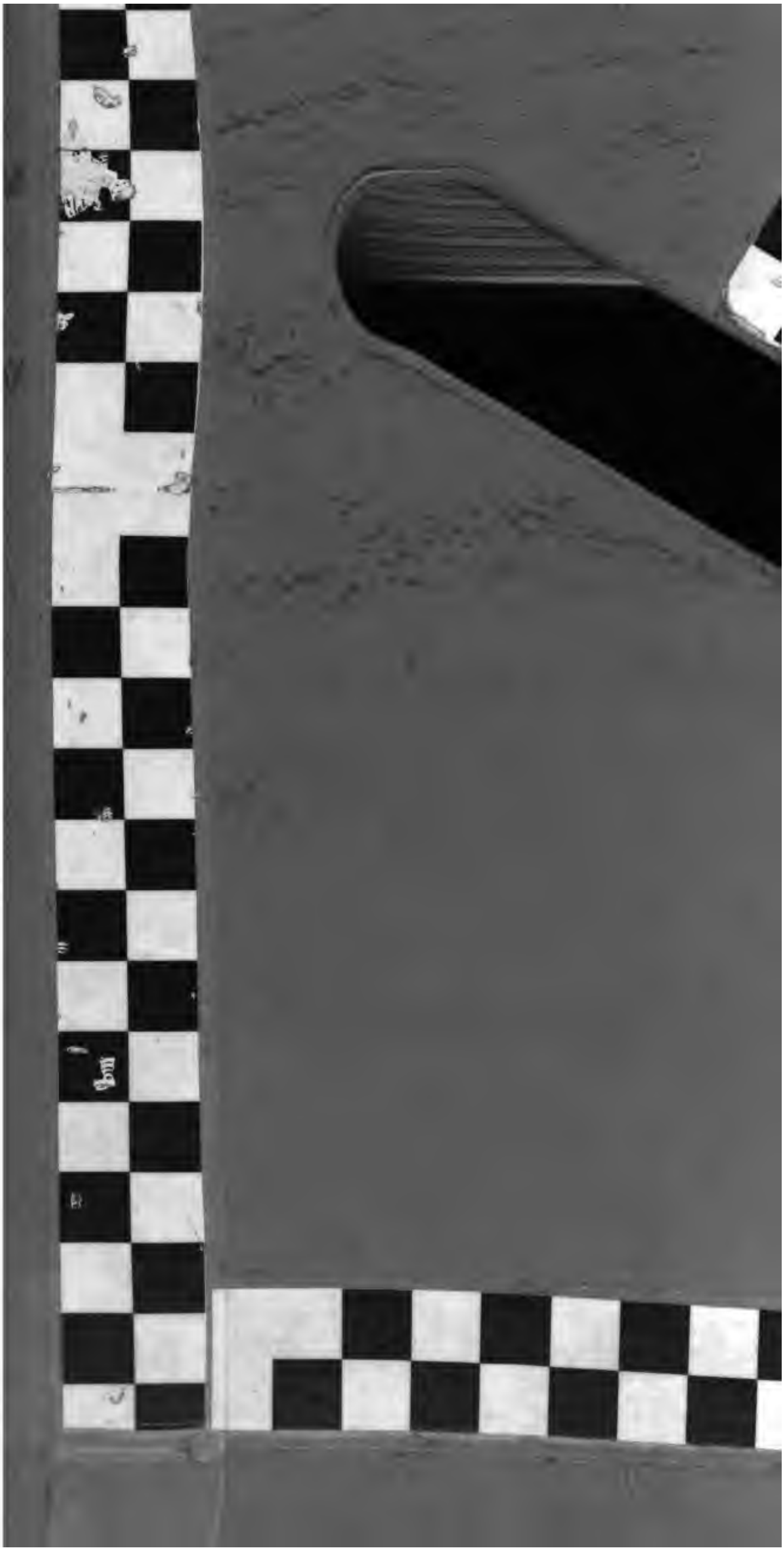
LOCATION.	DIAM. INCHES.	KIND.
Trombly st., Oakland to Hastings	6	iron.
" Crystal to Russell	4	"
" Russell to 20 ft. e. of w. of Dubois	8	"
" 183 ft. w. of to Chene	6	"
" Chene to w. line of Collins	4	"
" crossing Collins	6	"
" e. line of Collins to 72 ft. e. of Ellery	4	"
" 72. ft. e. of Ellery to e. line of Mt. Elliott	6	"
Trowbridge ave., 16-in. main to e. line of Woodward	6	"
" e. line of to 511 ft. e. of Woodward	4	"
Trumbull ave., alley s. of to Abbott	10	"
" Abbott to 30 ft. n. of	6	"
" Michigan to Plum	6	"
" Grand River to alley n. of	6	"
" Calumet to Forest	8	"
" Forest to 497 ft. n. of G. T. R. R	6	"
" 497 ft. n. of G. T. R. R. to 50 ft. n. of Piquette	8	"
" 50. ft. n. of Piquette to Holden	6	"
" alley w. of, Cherry to Pine	8	"
" alley w. of, Pine to Myrtle	4	"
" alley w. of, alley n. of Grand River to Calumet	6	"
Tuscola st., Fourth to Third	6	"
" alley s. of, Greenwood to alley w. of Fourth	4	"
Twelfth st., 458 ft. s. of to River st	4	"
" 17 ft. s. of n. of River to 31 ft. s. of n. of Lafayette	8	"
" 26 ft. s. of n. of Howard to 25 ft. s. of n. of Baker	8	"
" Baker to Calumet	6	"
" Calumet to s. line of Boulevard	8	"
" s. line of to 16 ft. s. of n. line of Boulevard	10	"
" alley w. of, from 121 ft. s. of to Porter	4	"
Twentieth st., Fort to Michigan	6	"
Twenty-first st., Fort to Standish	4	"
" alley w. of, Brevoort to Webster	4	"
Twenty-second st., Fort to Dalzelle	6	"
Twenty-third st., Fort to Magnolia	6	"
" Magnolia to 35 ft. s. of Linden	8	"
" 35 ft. s. of Linden to 100 ft. n. of Poplar	4	"
" 100 ft. n. of Poplar to Kirby	6	"
" Kirby to s. line of McGraw	4	"
" s. line of McGraw to Ivy pl	6	"
Twenty-fourth st., River st. to Fort	4	"
" Fort to Baker	6	"
" Baker to s. line of Michigan	8	"
" s. line of to 52 ft. n. of Michigan	16	"
" 52 ft n. of to 138 ft. n. of Michigan	18	"
" 138 ft. n. of to 192 ft. n. of Michigan	20	"
" 192 ft. n. of Michigan to Butternut	24	"
" Butternut to Buchanan	10	"
" Buchanan to n. line of McGraw	8	"
" n. line of McGraw to Chope pl	6	"
Twenty-fifth st., Howard to Baker	4	"
" Baker to Toledo	6	"
" E st. to Michigan	4	"
" Michigan to Hancock	6	"
" crossing Warren	6	"
" 69 ft. s of Hudson to n. line of McGraw	6	"

LOCATION.	DIAM. INCHES.	KIND.
Twenty-sixth st., 213 ft. s. of E st. to 146 ft. s. of Hancock	6	iron.
" 146 ft. s. of to 421 ft. n. of Hancock	8	"
" 421 ft. n. of Hancock to McGraw	6	"
Twenty-seventh st., Myrtle to s. line of Buchanan	6	"
" crossing Buchanan	8	"
" n. line of Buchanan to 32 ft. n. of s. of McGraw.	6	"
Twenty-eighth st., Michigan to 14 ft. n. of Rich	6	"
Twenty-ninth st., 565 ft. s. of Michigan to Buchanan	6	"
Union st., Fifth to Fourth	3	"
Uthes st., McKinstry to Clark	4	"
Van Dyke ave., Jefferson to 150 ft. n. of Waterloo	8	"
" 276 ft. s. of n. line of, to n. line of Worcester	8	"
" n. line of Worcester to Mack	6	"
" Mack to n. line of Gratiot	8	"
" Gratiot to Harper	6	"
" Jefferson connecting with 42-inch main 22 ft. of	10	"
Vincennes st., McClellan to 172 ft. e. of e. of same	6	"
Vine st., crossing e. side of Fifth	4	"
" Fifth to Fourth	3	"
Vinewood ave., Fort to Buchanan	24	"
" Buchanan to Merrick	10	"
" Merrick to Grand River	8	"
" Fort to 430 ft. n. of Toledo	6	"
" F st. to Buchanan	6	"
" crossing Vinewood, s. of M. C. R. R. betw. mains, 22 ft	6	"
Virginia ave., Hamilton Boulevard to w. line of Woodward, n. and s. sides,	4	"
" 5 ft. e. of w. line of, to 16-inch main in Woodward	6	"
Visgar st., Twenty-eighth to Lovett	6	"
" crossing e. side of Scotten	6	"
" La Salle to Vinewood	6	"
Wabash ave., n. line of M. C. R. R. to n. line of Ottawa	6	"
" n. line of Ottawa to s. line of Buchanan	4	"
" s. line of Buchanan to s. line of Grand River	8	"
" crossing Grand River	6	"
" n. line of Grand River to 18 ft. s. of s. line of L. S. & M. S. R. R	8	"
" 18 ft. s. of s. of L. S. R. R. to 186 ft. n. of Piquette	6	"
" crossing N. Boulevard	6	"
Walbridge st., Baldwin to Van Dyke	6	"
Walker st., Atwater to Jefferson	4	"
Walnut st., 264 ft. w. of to Van Dyke	6	"
Warren ave., w. line of Scotten to Grand River	6	"
" Sixteenth to Fourteenth	4	"
" alley w. of Wabash to Avery	4	"
" Twelfth to 195 ft. w. of (n. side)	4	"
" Trumbull to 106 ft. w. of Seventh	6	"
" 106 ft. w. of Seventh to Greenwood	4	"
" Greenwood to Third	6	"
" Third to Cass	8	"
" 6 ft. e. of w. of Cass to 105 ft. e. of Riopelle	4	"
" Warren ct. to w. line of Dubois	4	"
" crossing Dubois 56 ft	6	"
" e. line of Dubois to e. line of Grandy	4	"
" 12 ft. e. of w. of to 10 ft. w. of e. of Jos. Campau	6	"
" crossing Collins	6	"
" w. line of Moran to Detloff ct	6	"
" 2 ft. e. of w. to e. line of Mt. Elliott	6	"

LOCATION.	DIAM. INCHES.	KIND.
Warren ave., Helen to 228 ft. e. of same	4	iron.
Warren ct., 181 ft. s. of to 56 ft. n. of Warren ave	4	"
Warsaw pl., 17 ft. e. of Dequindre to St. Aubin	6	"
Washington ave., Michigan to State	30	"
" Michigan to Park	10	"
" alley w. of, from alley s. of State to alley s. of Bagley.	4	"
" alley e. of, from alley s. of State to alley w. of Woodward	4	"
Waterloo st., Dequindre to Jos. Campau	4	"
" Jos. Campau to Burlage pl	6	"
" Burlage to Mt. Elliott	8	"
" Mt. Elliott to 56 ft. e. of Beaufait	4	"
" 56 ft. e. of Beaufait to Bellevue	6	"
" Field to Sheridan	6	"
" Townsend to Baldwin	6	"
Watson st., Woodward to Brush	4	"
" Brush to Reservoir.	24	"
" Dequindre to Chene	4	"
Wayne st., s. from Woodbridge 173 ft	4	"
" Woodbridge to Michigan	6	"
Webster pl., Twenty-second to alley e. of same	6	"
" Nineteenth to alley w. of Eighteenth	4	"
Webb ave., e. line of Hamilton Boulevard to w. line of Woodward	4	"
" w. line of Woodward to 16-in. main	6	"
Welch ave., Plumer to s. line of M. C. R. R	6	"
" 211 ft. s. of to 309 ft. n. of Stark	6	"
" s. line of Ingersoll to n. of city limits	6	"
Wesson ave., Toledo to Herbert	6	"
West Boulevard, (both sides), Fort to Shady lane	4	"
" (w. side), Shady lane to Baker	3	"
" (w. side), n. line of Dix to n. line of Toledo	4	"
" (w. side), E. st. to 444 ft. s. of Michigan	6	"
" (w. side), 444 ft. s. of to s. line of Michigan	4	"
" (w. side), crossing Michigan	6	"
" (w. side), Michigan to Myrtle	6	"
" (e. side), Baker to 196 ft. n. of Toledo	6	"
Western Hay Market, 171 ft w. of to Trumbull	8	"
Westminster ave., 16-in. main to 1,222 ft. e. of Woodward	6	"
Whipple st., Baldwin to Van Dyke	4	"
Whiting ave., Jos. Campau to 1,880 ft. e. of same	4	"
Widman pl., Harper to Milwaukee	6	"
Wight st., Chene to McDougall	4	"
" McDougall to Mt. Elliott, w. line of	10	"
" w. line of Mt. Elliott to 110 ft. e. of Meldrum	6	"
" alley s. of, from McDougall to 230 ft. e. of same	4	"
Wilcox st., Woodward to Miami	12	"
Wilkins st., Brush to Russell	4	"
" 158 ft. w. of Riopelle to Orleans	4	"
" Orleans to 30-in. main in Chene	8	"
Willard st., Van Dyke to 255 ft. e. of same	4	"
Williams ave., Michigan to Hancock	6	"
" crossing Warren	6	"
" Merrick to Hudson	6	"
" Stanley to McGraw	6	"
Willis ave., crossing e. side of Twelfth	4	"
" e. line of Twelfth to Avery	6	"
" Eighth to Sixth	4	"

LOCATION.	DIAM. INCHES.	KIND.
Willis ave., Greenwood to Fourth	4	iron.
“ Fourth to Woodward	6	“
“ Woodward to Beaubien	4	“
“ Beaubien to St. Antoine	3	“
“ St. Antoine to Hastings	6	“
“ Hastings to 356 ft. e. of same	4	“
“ 356 ft. e. of Hastings to Rivard	3	“
“ Rivard to Russell	6	“
“ Russell to e. line of Chene	4	“
“ e. line of Chene to Grandy	3	“
“ Jos. Campau to Collins	6	“
“ Collins to 146 ft. e. of same	4	“
“ crossing Moran, w. side	6	“
“ Moran to alley w. of Mt. Elliott	4	“
“ alley s. of, from 20 ft. n. of s. of Willis to alley w. of Avery	4	“
Winder st., Woodward to w. line of Beaubien	4	“
“ crossing Beaubien	6	“
“ e. line of Beaubien to Orleans	4	“
Wing pl., Nineteenth to alley w. of Eighteenth	4	“
Winslow ave., Grand River to 85 ft. n. of same	4	“
“ 85 ft. n. of Grand River to McGraw	6	“
Winter st., Dequindre to 431 ft. e. of same	4	“
Witherell st., Woodward to Miami	16	“
“ Woodward to Miami	6	“
“ Miami to Adams	4	“
“ Adams to alley s. of Elizabeth	3	“
“ alley s. of Elizabeth to Columbia	6	“
Wolff st., Scotten to 357 ft. e. of same	4	“
Woodbridge st., Second to First	6	“
“ First to Griswold	4	“
“ Griswold to 24 ft. e. of w. of Woodward	6	“
“ 24 ft. e. of w. of Woodward to 6 ft. e. of e. line of St. Antoine	8	“
“ 6 ft. e. of e. of St. Antoine to Dubois	6	“
“ 300 ft. w. of to Jos. Campau	6	“
“ Joseph Campau to 400 ft. e. of same	4	“
“ 400 ft. e. of Jos. Campau to McDougall	6	“
“ 325 ft. w. of to Leib	4	“
“ alley s. of, Bates to Randolph	4	“
“ alley s. of, Brush to 210 ft. e. of Beaubien	4	“
“ alley s. of, McDougall to Walker	4	“
Woodland ave., 16-in. main to e. line of Woodward	6	“
“ e. line to 780 ft. e. of Woodward	4	“
Woodward ave., (e. side), s. from Atwater 246 ft	3	“
“ (e. side), Milwaukee to 102 ft. s. of N. Boulevard	6	“
“ (e. side), 102 ft. s. of to N. Boulevard	4	“
“ (e. side), crossing s. side Melbourne	6	“
“ (e. side), crossing Chicago Boulevard	6	“
“ (e. side), crossing Boston Boulevard	6	“
“ (w. side), s. from Atwater 171 ft	4	“
“ (w. side), crossing Virginia ave	6	“
“ (w. side), crossing Shakespeare Boulevard	6	“
“ (w. side), crossing Schiller Boulevard	6	“
“ Atwater to Jefferson	16	“
“ Jefferson to Soldiers' Monument	24	“
“ Bagg to Edmund	24	“
“ Atwater to Adams	8	“

LOCATION.	DIAM. INCHES.	KIND.
Woodward ave., Adams to Baltimore	10	iron.
“ Baltimore to Clay	8	“
“ N. Boulevard to Woodland	16	“
“ Woodland to 15 ft. n. of city limits	12	“
“ High to 200 ft. n. of Canfield	4	“
“ alley e. of, alley s. of Atwater to alley s. of Jefferson	4	“
“ alley e. of, alley s. of Larned to alley s. of Cadillac sq	4	“
“ alley e. of, alley s. of to Gratiot	6	“
“ alley e. of, Gratiot to 12 ft. s. of n. of John R	8	“
“ alley e. of, 12 ft. s. of n. of John R. to 172 ft. s. of Witherell	6	“
“ alley e. of, (private alley), 80 ft. s. of to Witherell, 97 ft.	3	“
“ alley e. of, alley s. of Elizabeth to s. line of Elizabeth	3	“
“ alley e. of, crossing s. side of Elizabeth	4	“
“ alley e. of, Elizabeth to Columbia	6	“
“ alley e. of, Columbia to Montcalm	4	“
“ alley w. of, Atwater to alley s. of Jefferson	4	“
“ alley w. of, alley s. of to Larned.	4	“
“ alley w. of, Larned to Congress	8	“
“ alley w. of, Congress to alley s. of Fort	4	“
“ alley w. of, alley s. of State to alley e. of Washington	4	“
“ alley w. of, Montcalm to High	3	“
Woodward ave. terrace, Woodward to w. line of John R.	4	“
Wreford pl., crossing w. side of Vinewood	6	“
“ crossing Hubbard Boulevard	6	“
Wreford ave., Grand River to Eighteenth	4	“
Zender pl., Ellery to 288 ft. e. of same	6	“
“ 288 ft. e. of Ellery to Mt. Elliott	4	“



Annex

FORTY-SECOND ANNUAL REPORT OF THE BOARD OF WATER COMMISSIONERS

NEW WATER WORKS.

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR

1893.

Calvert Lith. Co. Detroit

FORTY-SECOND ANNUAL REPORT

OF THE

Board of Water Commissioners

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT,

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1893.

DETROIT:
THE DETROIT FREE PRESS PRINTING COMPANY.
1894.

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Engin. Lib.
Gift
Prof. Head
1-27-32

BOARD OF WATER COMMISSIONERS.

DETROIT, 1893.

MEMBERS:

JOSEPH L. HUDSON, 1892. AUGUST GOEBEL, 1894.
SAMUEL G. CASKEY, 1893. HENRY M. DUFFIELD, 1895.
FRANK E. KIRBY, 1896.

COMMITTEES:

Ways and Means	Commissioners DUFFIELD, HUDSON.
Extension and Construction	Commissioners HUDSON, KIRBY.
Pumping Works	Commissioners KIRBY, CASKEY.
Supplies	Commissioners CASKEY, DUFFIELD.

OFFICERS:

President	AUGUST GOEBEL.
Vice-President	FRANK E. KIRBY.
General Superintendent Secretary	L. N. CASE.
Civil Engineer	G. S. WILLIAMS.
Supt. of Extension	HENRY BRIDGE.
Supt. of Meters and Inspection	THOMAS R. PUTNAM.
Supt. of Grounds	E. A. SCRIBNER
Chief Engineer	URIAH GOULD.
First Assistant Engineer	THOMAS SPACKMAN.
Consulting Engineer	JOHN E. EDWARDS.
Meter Clerk	HARRY S. STARKEY.
Assessors and Collectors	FRED. H. HUTAFF. AUGUST GOEBEL, Jr. JOHN J. ROBINSON. PETER J. BECKER. THOS. W. GOODALE. ANTHONY VOGEL. CHARLES J. PATERSON. GEORGE A. WINSLOW.
Receiving Clerk	GEORGE E. KUNZE.
Permit Clerk	JOHN E. LONG.

DETROIT WATER WORKS.

METER RATES.

First 3,000 Cubic Feet, each month, each 100 gallons	⅔ of a cent.
All over, each 100 gallons	⅓ of a cent.

ASSESSMENT RATES.

FROM JULY 1st, 1886.

		PER ANNUM
For Family, household purposes		$5 00
Green Houses.—Special rates.		
Private Stables, for each horse		2 00
Livery Stables, " " "		2 00
Dray and Team Horses, each		1 00
Cows, each		1 00
Stores and Offices	$2 00 to	20 00
Bakeries, average daily use, for each barrel of flour		3 50
Saloons, Groceries and Provision Stores, from	$3 00 to	100 00
Bar, with faucet, from	8 00 to	50 00
Fish Houses	10 00 to	100 00
Slaughter Houses.—Special rates.		
Hotels and Taverns, in addition to family rate, each room		1 00
Boarding Schools, each room		1 00
Public Schools, from	$5 00 to	50 00
Building Purposes, each 1 M brick		5
" " " 100 yards plastering		10
" " " perch stone		1½
Printing Offices.—Special rates.		
Butcher Stalls, each not less than		3 00
Workshops, for 10 persons or under		3 00
" for each additional 10 persons		1 00
Estimated quantities of water each 100 gallons		2
Boarding Houses, in addition to family rate, each boarder		1 00

FIXTURES.

Bath Tubs, for families, 1st tub, $2; each additional		$1 00
Bath Tubs, public, each tub		5 00
Water-closets, for a family, 1st closet, $3 00; each additional, $2 00	$3 00 to	15 00
Water-closets, for Hotels, Stores, Factories, etc., for ten persons, $5 00; each additional person		25
Rod Water-closets, not less than		6 00
Urinals, not less than		2 00
Wash-Hand Basins, for family	$1 00 to	3 00
" " " for other purposes, each person		25
Permanent Wash Tubs		2 00
Hose, for lawn and street sprinkling purposes		*free.*
Hose, for other purposes	$3 00 to	30 00
Fountains	5 00 to	20 00
Street Sprinklers, each wagon		150 00

Where there is a waste of water a proper increase of rates will be made.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

WATER COMMISSIONERS' OFFICE,
DETROIT, January 30th, 1894.

To the Common Council of the City of Detroit:

GENTLEMEN—The Board of Water Commissioners respectfully submit their annual report for the year ending December 31st, 1893. The reports of their subordinate officers, covering in detail the operations of the Board, are in the hands of the printer, and will be presented to your honorable body immediately upon their completion.

As reported in our last annual report, the litigations growing out of the Hurlbut will had then been adjusted, and therefore your Commissioners were at liberty to enter upon certain expenditures to improve and beautify the Water Works Park.

During the last year an iron fence, running along the entire frontage of the grounds and one hundred feet back from the front upon each side, has been constructed. A contract has also been entered into for the construction of a gateway costing $30,000. This was designed to be a memorial tribute to Mr. Hurlbut, and for this reason is styled, and the words engraved on its front, "The Hurlbut Memorial Gate." This is about one-half completed at the present time.

These improvements, together with others being made in the grounds, its increased floral display, the planting of ornamental shrubbery and trees, and the reclaiming of the marshy portion of the grounds near its western frontage on the river, by means of a miniature canal and islands, will render the park as enjoyable and fully as interesting as any in the city.

The new engine contracted for about one year ago is very nearly completed.

During the year, $146,000 of bonds came due. It became necessary, for the redemption of these bonds, to effect a loan of $75,000 for one year, and which was done by procuring the extension of bonds to that amount and for the said time at six per cent interest.

The expenses during the past year for general construction have been large. The readjustment of our pipeage system, the details of which will be found in the Civil Engineer's report, has been accomplished at an expense of about $78,000. The results attained are very apparent to many of the consumers, who have hitherto been much annoyed by short supplies and low pressures, and are fully set forth in the report above referred to.

We have labored to meet the fullest needs of the city, and at the same time preserve the economy of our administration. The results, as set forth in the following comparative statement for the years 1888 to 1893, fully justify this statement:

YEARS.	Population.	Operating Expenses.
1888	194,247	$93,783 50
1889	205,598	93,931 00
1890	215,808	95,746 85
1891	230,051	88,086 62
1892	240,563	91,534 82
1893	257,050	92 031 40

From this it appears that with a population in 1893 of 62,000 more people to supply than in 1888, with all the attendant growth of manufacturing and business interests, the operating expenses were more than $1,700 less than in 1888. Almost all this saving is attributable to the use of meters by all large consumers. Upon a conservative estimate, the annual saving from the use of meters alone is not less than $50,000. This is not only a saving in the expense to the city, but, with very few exceptions, a reduction of the cost to manufacturers and metered consumers.

The suggestion that is made to abolish water rates and raise the necessary expenses of a water supply by general taxation, will, upon reflection, be seen to be so utterly impracticable and chimerical that it does not merit discussion.

The detailed statement of expenditures already submitted to your honorable body, for the year 1893, and those regularly submitted every January for each previous year, prove conclusively that no public funds have been used by this Board to influence any proposed legislation respecting the Board, and the undersigned supplement this evidence with their several denials that anything of the kind has ever occurred during their respective terms of office, and repudiate any statements or insinuations to that effect as wholly false and without any justification. Whatever may be the case in other departments of the municipal government, the Board of Water Commissioners cannot be pilloried in court for unlawfully using its funds with the legislature, or for any purposes foreign to the object for which it was created.

All of which is respectfully submitted.

AUGUST GOEBEL,
SAMUEL G. CASKEY,
HENRY M. DUFFIELD,
FRANK E. KIRBY,
JOSEPH L. HUDSON,
Commissioners.

REPORT

OF THE

GENERAL SUPERINTENDENT AND SECRETARY.

JANUARY 2d, 1894.

To the Board of Water Commissioners:

GENTLEMEN—I respectfully submit my report of the general operation and construction of the works for the preceding year, together with statements of the financial transactions of the Board.

CONSTRUCTION.

The construction of the works may be divided into two classes, ordinary and extraordinary. The ordinary construction is that which is included in the extension of pipe to keep pace with the growth of the city, the purchase and placing of meters, and such other incidentals as naturally occur in each department. The extraordinary is the laying of large supply mains, the purchase of new machinery, and the erection of buildings, in fact what may be called the enlargement of the works.

The entire expenditures for construction were $378,048.94, of which $210,152.52 was for extraordinary construction, less $11,000, excess of pipe on hand this year over last. This amount includes $110,572.47 expended at the pumping works for the new engine, the enlargement of the engine and boiler houses, the building of a new conduit, and the rearrangement and addition to the system of force mains within the grounds. Additional to this is the expenditure of $22,049.56, chargeable to the Hurlbut Fund, and expended for the construction of the iron fence, the Hurlbut Memorial Gateway, and the general improvement and care of the grounds, making the total of extraordinary construction $232,202.08.

It includes about $78,634.45 expended in readjusting the general

PIPEAGE SYSTEM.

In my report for the year 1891, I referred at some length to the great differences in pressures throughout the city. I stated that I had placed, through the courtesy of the Fire Department, in different engine houses, thirteen pressure gauges, and had had a record made of their readings every hour.

This idea was the outgrowth of numerous and constant complaints having been made to me of short supplies and low pressures in certain localities, and was adopted simply to obtain absolute and reliable information.

I reported also at that time that certain gates controlling the supply of water to these localities where the pressures were unusually large had been partially closed, which had the effect only of partially curing the evil.

With the very limited knowledge of engineering that I possessed, or was had by any of the then employés of the Board, it was impossible to arrive at the true cause that was producing this *unhealthy* condition, and not knowing the cause, it was impossible to cure it. This condition continued to exist, with but little variation, during the succeeding year of 1892. Early in the year just passed, a civil engineer was employed by the Board, and reported to me for duty. I requested him to commence an immediate and thorough study of our entire pipeage system. I gave him the data I had collected, and asked him to report to me the results of his labors as soon as he possibly could.

That report was received and read to your honorable body, showing conclusively the mistakes that had been made and the steps necessary to take to remedy the evil.

His recommendations were concurred in, and he was instructed to carry out his plan for the rearrangement of the system.

This work and the results therefrom are best understood from his own report. I will simply refer you to the following statement, showing the elevations of water before and after the changes in the system had been made:

LOCATION.	FORMER ELEVATIONS.	PRESENT ELEVATIONS.
Corner Russell st. and Ferry ave	2.6 feet.	28.6 feet.
Alexandrine and Cass aves	31.2 "	43.1 "
Russell and High sts	29.3 "	41.6 "
Gratiot and Grandy aves	29.3 "	45.5 "
Grand River ave. and Sixteenth st	34.9 "	39.3 "
Woodward and Milwaukee aves	19. "	40.5 "
Bagg and Sixteenth sts	44.1 "	46.7 "
Fort st. and Elmwood ave	44.8 "	52.2 "
Baker and Sixth sts	43.3 "	57.8 "
Scotten and Michigan aves	51.5 "	52.2 "
Hubbard ave. and Fort st	58.9 "	58.9 "
Jefferson ave. and Randolph st	49. "	49.7 "
Bagley ave. and Clifford st	46. "	64.4 "

A water-works of the size and importance of Detroit, and in fact any water-works, is not complete without its civil engineer to advise and counsel with, and I congratulate the Board upon having procured one of unquestionable ability.

METERS.

The introduction of meters has continued during the past year, but not of course with as largely beneficial results as shown in the four years previous. One of the causes for this is the fact that most of the meters placed during the year were upon small consumers, the larger ones having already been metered. Up to this time meters have only been placed on business houses, stores, factories, etc., and hardly any, only by request, upon families. This fact alone would prevent any such showing as those of 1889, 1890, 1891 and 1892. Another cause for the increased amount pumped is this, that during the year the pressure of water has been materially increased. The average increase was five pounds, or what is equivalent to an extra elevation of nearly twelve feet, and twenty-eight per cent. over the previous average. This increased pressure largely increases the quantity of water discharged through an orifice in a defective water pipe, or through a faucet purposely or accidentally left open.

The amount of water pumped each hour during the day and night indicates conclusively that during each hour about 800,000 gallons are wasted. This waste is undoubtedly very largely caused by constantly flowing streams, of greater or less size, throughout the whole system of supply, not only in defective service pipes and fixtures but in the pipeage system itself. I have already submitted this matter to the engineer and requested him to devise some means of investigating and locating the leaks that are existing in the supply and distribution mains, which will be probably attended to during the coming year. The work of the examiners under Superintendent Putnam is already accomplishing this work as far as service pipes and fixtures in houses are concerned.

I desire in this connection to introduce an article from the pen of Col. William Ludlow, a distinguished engineer of national reputation, and one who has been in a position to judge, and with an education and intellect to appreciate all of the features and influences that pertain to the subject of water supply, the necessity for preventing waste and the means that should be adopted to accomplish hat result.

READ IT.

THE OPINION OF AN EXPERT.

Water waste arises from many causes—leaky mains and pipes, defective appliances of all kinds, lack of supervision of public openings, and the perpetual flow from horse-troughs, bar-rooms, hotels, private houses, etc. In addition, is the immense loss through factories and mills, where the pipes are constantly flowing, and which do not even shut off the water when the works are closed.

There are but two practicable methods of checking this waste, viz.: by a system of inspection and enforcement of penalties, and by measuring and charging for the quantity taken. The former plan involves domiciliary visiting, always cumbersome and objectionable, by an army of inspectors, subject to both obstruction and improper influences in the discharge of their duties, and unless thoroughly systematized and maintained and aided by indirect instrumental determinations, is, in the nature of things, an approximation only to an effective method.

Actual measurement is preferable, as being more exact, automatic, effective and equitable. The water meter is merely a sleepless and tireless machine, not susceptible to bribery or violence without discovery, requiring little attention, and recording actual consumption regardless of the disposition made of the water which passes through it.

The two systems may be compared by supposing a given establishment to be furnished with gas at an annual rental, and its economical use dependent upon the carefulness of the occupants and an occasional visit by an inspector.

It is sometimes said that water should be as "free as air," and in truth it is to any one who chooses to procure it for himself, as light is free to him who goes to bed at dark; but he who wishes either light or water supplied to him, when and where and in such amount as he shall choose, must manifestly pay for it, and the meter will enable the department to make out just bills, and at the same time hold the water-taker responsible for the waste due to carelessness, willfulness or defective appliances. When this system has been intelligently carried out, as in some of the better managed cities, such as Providence, the results show that the legitimate consumption of water for all purposes is from thirty to forty gallons.

The argument that an undesirable economy might be exercised among a class of population whose use of water should be encouraged, may be met by fixing a minimum allowance and charging by meter for all beyond that.

It is natural, perhaps, that city officials should turn their attention to drawing from new sources and increasing the machinery of their department, rather than undertake the unpopular and thankless task of restricting waste. No one knows, who has not attempted it, how difficult it is to correct abuses of long standing. Few citizens are liberal or intelligent enough to voluntarily aid in securing a public benefit, or necessity even, if it must be accomplished at the cost of any inconvenience or restriction to themselves. Touch the purse-strings, however, and it can be done. With the meter registering waste, defective appliances will be repaired, carelessness of servants and employés corrected, the water closet will have a proper flushing tank instead of a constant flow, and the water will not be used in winter to protect a badly-laid pipe from freezing, or the owner from a plumbing bill.

The waste from these sources, though of no great apparent amount in a single instance, when multiplied by the immense number in use, represents a formidable quantity, which, having been brought at great expense from the source of supply, flows to tide water without having served any useful purpose whatever.

[Signed] COL. WM. LUDLOW.

HISTORICAL.

The following table is one published last year, with the addition of the results of 1893:

YEARS.	Families Supplied.	WATER PUMPED.		REMARKS.
		Total Quantity.	Per Family.	
1852........	......	235,840,275	....	
1853........	4,283	303,531,743	70,868	
1854........	4,619	376,265,126	81.460	
1855........	5,282	542,807,364	102,765	
1856........	5,706	692,124,305	121,297	
1857........	6,189	697,190,523	112,650	
1858........	6,474	718.091,207	110,919	
1859........	6,794	782.112.587	115,118	
1860........	6,750	870.036,451	125,185	
1861........	7,128	895,129,423	125,579	
1862........	7,275	994,945,329	136,762	
1863........	7,699	1,035,798,043	134,534	
1864........	7,993	1,019,390,256	127,410	
1865........	8,351	1,040,514,887	125,675	
1866........	9,089	1,196,317,922	131,622	
1867........	10,242	1,425,535 230	139,186	Average per cent. of increase from 1852 to 1888—12.86.
1868........	11,544	1,666,545.125	144.364	
1869........	12,774	1,946.810,325	152,400	
1870........	13,722	1,866,060,068	136,000	
1871........	14,896	2,300,150 605	154,414	
1872........	16,035	2,782,292,578	173 513	
1873........	17,019	3,198,393,948	187,930	
1874........	18,853	3,289,872,635	174.511	
1875........	19,606	4,207,454,260	214,600	
1876........	20,102	4,065,134,470	200,225	
1877........	20,345	4,213,239,790	207,090	
1878........	20,603	4,345,743,330	210,927	
1879........	21,341	5,129,599,110	240,348	
1880........	22,465	5,552,965,310	247,183	Average per cent. of increase from 1879 to 1888, inclusive, 8.5.
1881........	23,749	6,543,127,968	279,722	
1882........	25,442	6,284,000.742	243,062	
1883........	27,415	7,379,327,788	269,170	
1884........	29,424	8,510,614,140	289,260	
1885........	30,533	9,970,829,580	326,886	
1886........	31,946	10,576,571,254	331,070	
1887........	34,486	13,168,859,808	381,860	
1888........	36,863	**14,380,166,670**	**390,098**	
1889........	39,158	12,875,334,453	328,880	*Commenced Metering.*
1890........	41,467	12,120,944,532	292,300	
1891........	43,933	12,057,261,236	274,470	
1892........	46,400	12,276,612,482	264,582	
1893........	49,817	13,877,977,208	278,579	

It will be seen that the average per family has increased to a little more than that of 1891, and for the reasons given previously. Although there seems to be a falling off in the good results obtained so far, yet when we consider that the total quantity pumped is still considerably less than that of 1888, notwithstanding that 13,000 families, or a population of 66,500, have been supplied in excess of that of 1888, it will be seen that the results achieved are still enormous.

The following table, showing the amount of water it is reasonable to estimate would have been pumped, upon the basis of information gained from the table preceding, and also showing the quantity actually pumped, will give the actual amount saved.

YEARS.	Families Supplied.	Would have Pumped.	Actually Pumped.	Saved.
1889..........	39,158	16,573,858,448	12,875,334,453	....
1890..........	41,467	19,042,973,344	12,120,944,532	....
1891..........	43,933	21,890,320,178	12,057,261,236	....
1892..........	46,400	25,084,675,200	12,276,612,482	....
1893..........	49,817	29,221,157,690	13,877,977,208	....
In 5 Years..	....	111,812,984,860	63,208,129,911	48,604,854,949

The above results are arrived at by taking the average increase for ten years previous to 1889, which was 8.5 per cent, and assuming that the quantity pumped would have increased each year in the same ratio. Looking back over the column, in first table presented, marked "total quantity," the assumption, or estimated quantity that would have been pumped, is justified.

FINANCIAL SAVING EFFECTED.

In my last annual report, I entered very exhaustively into a mathematical calculation of the amount saved to the Board during the years 1889, 1890, 1891 and 1892, by the introduction of meters. The actual amount saved up to January 1st, 1893, was $235,408.35. As shown by the foregoing table, the amount saved during the past year is greater than the average of the four years previous, notwithstanding the fact that the pro rata per family has been increased.

For the details of the operation of this department, I would respectfully refer you to the report of Supt. Putnam.

PUMPING WORKS.

The construction at the Pumping Works, above referred to, is very near completion. The use of crude oil as a fuel has been, if anything, more satisfactory than was estimated. For cleanliness and the ease with which it is handled and used, it has no equal; and when it is considered that its cost to the Board for the year 1893 was about $27,000, with a saving in labor o $2,280, and that the cost of fuel in 1888 was about $39,000, with this additional cost of labor, the financial saving by its use can be fully appreciated.

The amount expended at the works since its original establishment, including that expended on the grounds and chargeable to the Hurlbut Fund, is shown in the following table:

ITEMS.	Previously Expended.	1893.	Total.
Land	$35,000 00	....	$35,000 00
Force Mains	609,414 77	$12,552 92	621,967 69
Inlet Pipes	90,626 84	....	90,626 84
Dock, Basin and Canal	135,309 12	....	135,309 12
Conduits and Wells	73,710 52	3,960 00	77,670 52
Engine, Boiler and Coal Houses	164,132 14	24,974 98	189,107 12
Stand Pipe and Tower	30,420 72	....	30,420 72
Pump Wells	54,221 56	....	54,221 56
Engines	265,642 24	56,013 32	321,655 56
Boilers	44,248 40	10,000 00	54,248 40
Engineer's House	7,773 14	366 61	8,139 75
Sewer	3,666 25	....	3,666 25
Grounds, Fences and Gateway	54,632 32	22,890 12	77,522 44
Inspection	2,977 86	....	2,977 86
Miscellaneous	9,850 72	1,844 08	11,694 80
Total	$1,581,626 60	$132,602 03	$1,714,228 63

EFFECT OF WATER IN SEWERS.

Superintendent Putnam in his report speaks of the fact, that during the last year his examiners reported that in answer to their notice that water must not be allowed to run continually, they often received the information that this was done at the direction of the Board of Health.

He made some inquiries in regard thereto and found that the inspectors under the said Board were so instructing the people, saying it was to be done for the purpose of keeping the sewers clean.

It seems from the above that it is not only *not generally* understood, but very *seldom* understood, even by those whose education would indicate a knowledge of such things, that running streams in sewers have no effect whatever in dislodging and removing the depositions therein. The liquid matter in sewers is easily disposed of, in fact will care for itself, but the solid and greasy matter deposited therein cannot be disturbed unless it be by force such as is exercised by a "flush" or a sudden dump of water that will fill the sewer and rush impetuously towards an outlet.

As an illustration, last February an application was received to permit an attachment of a pipe placed in the Campbell avenue sewer where there was a considerable accumulation of solid matter in the bottom of the sewer. It was arranged so that at frequent intervals jets of water would be discharged downwards and would by mere force dislodge and break up this accumulation.

The permission was given, and a man sent to observe the conditions and measure the quantity of water consumed. One fact was startlingly corroborative of the opinion that flowing water in sewers accomplishes no good whatever towards removing solid matter deposited therein. In this sewer was found a flowing stream of over 12 inches in depth, which, instead of disturbing the solid matter beneath, was gradually yet surely increasing it by depositing matter carried along with it.

Witness the action going on continually in our water mains themselves, wherein the water occupies all the space and with a pressure in every direction of from 20 to 40 pounds to a square inch. If flowing streams can accomplish anything, they certainly ought under such conditions, and yet the fact is that there is gradually being deposited in the bottom of these pipes, from the water itself, solid matter that can only be removed by opening and closing gates in such manner as to send the water "skurrying" in the opposite direction from its usual course.

It is often complained that the use of meters, by causing an economical use of water, restricting its quantity and flow in sewers and preventing thereby a removal of the accretions therein, is directly responsible for the prevalence of diphtheria and other kindred diseases. On the contrary meters are a benefit in this direction, as they often influence the adoption and use of the tank closet as a matter of economy, which, discharging a few gallons of water at once, accomplishes more in cleaning out the waste pipe all the way to its entrance into the sewer than a running stream would accomplish in a week. The force of even such a small body of water rushing in one solid bulk through the confined area of a waste pipe will move everything before it.

At my request, Mr. Williams about the first of last October made some very interesting computations in regard to this question. He says that the best authorities agree that the velocity of flow in a sewer should be between two and three feet per second; that, assuming that our sewers are constructed correctly, the capacity of the several main sewers is 975,000 gallons per minute; and that the maximum capacity of the engines at the pumping works is only 5,400 gallons per minute, or one-eighteenth that of the sewers.

It will be seen from this that if the entire water supply were turned into the sewers that it would simply afford them running streams at their bottoms, that would accomplish nothing.

Another point he calls attention to is the fact that when the traps are partially open to permit the flow of water, an opportunity is offered for the passage of foul gases into the building. An experience of this nature happened in New York city in one of the hospitals. The same instructions were given there by the Board of Health as here, and the presence of foul gases was soon apparent which, after an investigation, was found to be coming through the partially open traps from the sewer. Of course the orders to "let the water run for the purpose of cleaning the sewers," were immediately rescinded.

Mr. Williams also gave some interesting data in regard to rain-falls. The area of surface drained by the sewers of Detroit is about 30 square miles. Experiments show that about 20 per cent. of the rain-fall reaches the sewers.

In the 940 minute storm of October 3d there fell 1,050,274 gallons of water, 20 per cent. of which passed into the sewers, or 210,055 gallons each minute, a quantity equal to *four* times the maximum capacity of our works.

In fact, we owe to our rain storms the cleanly condition of our sewers, and if it is found that in certain sewers, as I presume it may be, that rains do not accomplish this desired result, then some way must be adopted of flushing the sewers, something after the manner and upon the same principle as a tank closet. Running streams will not produce any such effect.

The "fooling" with fuel at the pumping works, as a correspondent with one of the daily papers designated it, "going from coal to gas, from gas to coal, to gas again and then to oil," has had the following pecuniary effect:

YEARS.	FUEL, LABOR, LUBRICANTS, &C.	PER MILLION.
1888	$60,284.11	$4 19
1889	61,560.48	4.78
1890	54,433.49	4.49
1891	53,012.77	4.39
1892	53,287.39	4.27
1893	46,546.01	3.35

The comparison is most favorable between the years 1893 and 1888 and 1889, as the quantity pumped during the year 1893 was about one thousand millions more than that of 1889 and about five hundred million less than that of 1888.

WATER WORKS BONDS.

The following table shows the whole history of the bonded indebtedness of the Board, in which will be seen that the total amount of bonds issued is $1,850,000, of which $692,000 have already been redeemed, leaving outstanding $1,158,000, upon which there is an annual interest of $70,820.

No. of Issue.	Act of	Issued.	Payable.	Amount.	Rate of Interest.	Redeemed.	Outstanding.
1st	1853	Aug. 1, 1853	Aug. 1, 1883	$100,000	7cts.	$100,000	....
"	"	" "	Aug. 1, 1878	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1873	50,000	7 "	50,000	....
2nd	1855	Aug. 1, 1855	Aug. 1, 1890	100,000	7 "	100,000	....
"	"	June 12, 1855	Aug. 1, 1885	100,000	7 "	100,000	....
"	"	" "	Aug. 1, 1880	50,000	7 "	50,000	....
3rd	1857	Aug. 1, 1858	Aug. 1, 1893	150,000	7 "	75,000	$75,000*
"	"	Aug. 1, 1867	Aug. 1, 1887	100,000	7 "	100,000	....
4th	1869	Feb. 1, 1870	Feb. 1, 1900	100,000	7 "	....	100,000
5th	"	Aug. 1, 1872	Aug. 1, 1902	50,000	7 "	....	50,000
6th	"	Aug. 1, 1873	Aug. 1, 1903	50,000	7 "	....	50,000
"	1873	Feb. 1, 1874	Feb. 1, 1904	50,000	7 "	9,000	41,000
7th	1869	Aug. 1, 1874	Aug. 1, 1904	50,000	7 "	6,000	44,000
"	1873	" "	" "	200,000	7 "	....	200,000
"	"	June 1, 1875	June 1, 1905	150,000	7 "	1,000	149,000
"	"	June 1, 1876	June 1, 1906	200,000	6 "	1,000	199,000
"	"	Sept. 1, 1880	Sept. 1, 1899	100,000	4 "	....	100,000
"	"	April 1, 1881	April 1, 1897	100,000	4 "	....	100,000
"	"	Dec. 1, 1881	Dec. 1, 1896	50,000	4 "	....	50,000
				$1,850,000		$692,000	$1,158,000

* Running one year at 6 per cent.

As stated one year ago, on the first of last August $146,000 of bonds, as shown above, became due and payable. In order to meet this demand it was necessary for the Board to negotiate a loan of $75,000, which was done, and that amount of the bonds falling due were practically reissued for *one* year at 6 per cent. interest.

The following table shows many details connected with the works and its operations that are of considerable interest. These details and conditions are given of the six preceding years, in order to show what has been done in the past five years by the measures adopted by the Board to prevent the waste of water.

Attention is called particularly to the last two lines of this exhibit, and a comparison invited between the years 1888 and 1893. Over $1,700 less of "actual operating expenses" and an increase in the population of 62,803, or 32⅓ per cent.

As will be seen by the table the per capita daily supply has increased from 140 to 148, and is explained on page 14.

The entire expense for pumping water during the year was $46,546.01, or $14,000 less than 1888 and $15,000 less than 1889.

COMPARATIVE STATEMENT

	1888.	1889.	1890.	1891.	1892.	1894.
Daily average consumption in gallons	39,397,716	35,274,888	33,208,067	33,033,592	33,634,554	38,021,855
Daily average consumption per capita	204	172	155	144	140	148
Total consumption in the year	14,380,166,670	12,875,334,453	12,120,914,532	12,057,261,236	12,276,612,482	13,877,977,208
Consumption through meters, gallons	91,750,000	139,090,000	626,944,765	1,194,842,400	1,589,885,250	1,771,834,500
Percentage of water metered	.00$\frac{3}{5}$	.01	.05$\frac{1}{5}$	.10	.13	.128
Revenue from unmetered water	$335.140.00	$354,016.00	$350,599.73	$342,395.89	$340,949.36	$348,454.96
Revenue from metered water	$9,175.00	$13,909.00	$37,278.00	$46,684.08	$61,585.62	$72,035.87
Per one thousand gallons metered water	.10	.10	.059	.038	.038	.04
Per one thousand gallons unmetered water	.023	.027	.03	.031	.034	.029
Number of families supplied	36,863	39,158	41,467	43,933	46,400	49,817
Number of service connections	31,821	37,725	40,351	43,727	47,281	48,657
Miles of pipe	325	343	362	405	432	455
Number of meters	48	204	866	1,239	2,053	2,588
Expenditures for maintenance	$101,019,00	$102,587.00	$102,391.00	$95,591.54	$99,561.52	$97,246.68
Actual operating expense	$93,783.50	$93,931.00	$95,746.85	$88,086.62	$91,534.82	$92.031.40
*Estimated population	194,247	205,598	215,808	230,051	240,563	

* Obtained by multiplying number of families by 5.12.

The following table is the report of the assessments made in May and June, to commence July 1, 1893.

The assessments were increased $16,776, notwithstanding there were taken from the assessment rolls and metered, and thereafter appear upon the meter books places, the aggregate assessments upon which amounted to $10,043, making the actual increase the sum of the two, or $26,819.

The number of families in the city not supplied are continually decreasing, amounting now to 388. The total number of families in the city is 50,205.

ASSESSMENT 1893-94.

Dist.	WARDS.	FAMILIES.			Vacant Tenements.	Increase Supplied.	ASSESSMENT.		
		Supplied.	Not Supplied.	Whole Number.			1893-94.	Increase or Decrease.	Reduced by use of meters.
1	Ninth.......	5,190	15	5,205	34	607	$29,783	+$2,643	$424
	Fifteenth...	2,438	55	2,493	19	523	15,502	+ 3,003	282
	Totals ...	7,628	70	7,698	53	1,130	45,285	+ 5,646	706
2	Eleventh ...	3,446	4	3,450	66	279	21,750	+ 2,134	246
	Thirteenth..	2,355	5	2,360	66	243	14,799	+ 1,771	243
	Totals ...	5,801	9	5,810	132	522	36,549	+ 3,905	489
3	First........	2,482	9	2,491	123	41	28,432	— 1,294	2,036
	Seventh	3,295	20	3,315	71	255	20,791	+ 862	611
	Totals....	5,777	29	5,806	194	296	49,223	— 432	2,647
4	Third........	3,271	14	3,285	70	126	21,695	+ 614	391
	Fifth........	3,621	8	3,629	41	53	22,782	+ 719	49
	Totals ...	6,892	22	6,914	111	179	44,477	+ 1,333	440
5	Second	2,010	11	2,021	122	— 4	27,208	— 1,606	2,199
	Sixth........	3,392	5	3,397	123	+ 37	25,374	— 106	1,284
	Totals ...	5,402	16	5,418	245	33	52,582	— 1,712	3,483
6	Tenth.......	4,048	9	4,057	68	165	25,428	+ 1,000	582
	Fourteenth.	2,189	41	2,230	48	177	13,197	+ 975	144
	Totals ...	6,237	50	6,287	116	342	38,625	+ 1,975	726
7	Fourth......	3,252	4	3,256	70	339	28,682	+ 1,350	923
	Twelfth	3,144	6	3,150	45	189	18,824	+ 1,004	329
	Totals ...	6,396	10	6,406	115	528	47,506	+ 2,354	1,252
8	Eighth......	3,161	1	3,162	52	27	23,056	+ 1,449	300
	Sixteenth...	2,523	181	2,704	24	360	15,167	+ 2,258	......
	Totals ...	5,684	182	5,866	76	387	38,223	+ 3,707	300
	Aggregate	49,817	388	50,205	1,042	3,417	352,470	+ 16,776	10,043

FINANCIAL STATEMENT.

The following is a complete statement of the financial transactions of the Board during the year 1893:

RECEIPTS.

Water Rates Account—	
Rates paid	$420,490 83
Percentage Account—	
From delinquents	6,802 76
Penalties for shutting off	443 50
Service Cocks Account—	
Labor and material	6,615 65
City of Detroit Account—	
Tax levy	69,167 77
Repairing Leaks Account—	
Labor	33 50
Real Estate Account—	
Rentals	2,316 67
Iron Pipe Account—	
Labor and materials	7,462 97
Bonus paid for extensions	1,574 95
Hurlbut Fund Account—	
Payment from trustees	2,400 00
Interest Account—	
On deposits general account	5,077 81
On deposits sinking fund	1,808 97
Plumbers' License Account—	
Paid for licenses	635 00
Pumping Works Account—	
Sale of old material	78 00
Meters Account—	
Sale of material	21 54
Pumping Water Account—	
For water by farmers	4 50
Total receipts	$524,934 42

EXPENDITURES.

FOR CONSTRUCTION.

Iron Pipe Account—		
Superintendent and clerks	$7,529 48	
Labor	88,742 05	
Iron pipe	97,055 97	
Special castings	13,795 29	
Tools and repairing of	1,562 52	
Hauling	2,672 96	
Lumber	1,234 12	
Coal	274 97	
Oil	49 70	
Packing	495 46	
Lead	4,577 46	
Plugs	151 73	
Repairs and materials for	36 77	
Repaving	6,480 31	
Street car and toll tickets	151 00	
Livery	69 00	
Wagon and harness supplies and repairs	227 25	
Feed	868 37	
Farrier	102 00	
Materials—lead pipe, solder, nails, etc	864 50	
Stationery books, etc	74 00	
Civil Engineer's salary	1,852 60	
Materials for iron pipe engineering	105 73	
Pressure pump	399 85	
Engine	100 00	
Brick	21 00	
Boring machine	76 60	
Switching charges for 1892	435 00	
Scales	39 90	
Refilling Brush street line	463 68	
Hospital and medical attendance	12 00	
Freight and express	36 96	
Gate wells	9,946 07	
Stop cocks	7,209 88	
Suction machine	66 25	
		$247,780 43
Pumping Works Account—		
Labor	$4,131 88	
Pipe and hauling	3,095 04	
Fixtures in engineer's house	75 00	

Work in and on engineer's house	$366 61	
Special castings, fittings, etc	7,099 76	
Repairs on engine and boiler houses and tower	8,609 89	
Damages	228 74	
Materials, lumber, etc	562 14	
Engine, boilers and foundations	66,013 32	
Cut stone work	4,212 00	
Mason work	4,918 35	
Carpenter work	800 41	
Iron work	1,900 00	
Slating and roof work	2,000 00	
Painting	2,014 70	
Waste gate	60 00	
Conduit to new engine	3,960 00	
Architect	519 63	
		$110,567 47
Oil Plant Account—		
Fittings for boilers	$24 99	
		24 99
Meter Account—		
Superintendent and labor	$8,845 48	
Meters	6,987 43	
Freight and express	41 04	
Specials and fittings	796 49	
Horse board and shoeing	184 50	
Repairs to harness and vehicles	15 80	
Street car tickets	20 00	
Hauling	103 25	
Materials—lumber, solder, etc	658 34	
Tools and repairing of	103 60	
Superintendent's expenses east	135 00	
Postage	83	
Printing, stationery and stamps	20 25	
Meter wells	46 10	
Meter repairs	9 75	
		17,967 86
Real Estate Account—		
Insurance	$284 54	
Plumbing	26 66	
Repairs to buildings	68 40	
		379 60
Engineering Account—		
Materials and instruments	$361 48	
		361 48

Horse and Wagon Account—		
Horses	$387 50	
Harness	25 00	
Vehicles and parts thereof	142 70	$555 20
Office Furniture and Fixtures Account—		
Furniture and fixtures	$411 91	411 91
Aggregate		$378,048 94

OPERATION AND MAINTENANCE.

Office Account—		
Secretary, assessors and clerks	$19,218 49	
Watchmen and janitors	1,462 65	
Printing and binding	1,259 00	
Advertisements and subscriptions	127 26	
Supplies—soap, matches, etc	237 23	
Stationery	365 96	
Extra services	658 95	
Expert examiners	5,215 28	
Fuel	675 06	
Light	271 64	
Postage and telegrams	171 17	
Attorney	450 00	
Memorial tribute	25 25	
Germicide	18 00	
Sprinkling	34 30	
Ice	29 25	
Street car tickets	43 00	
Horse board	165 00	
Farrier	24 50	
Harness and buggy repairs	44 50	
House and furniture repairs	41 82	
Medical attendance	4 00	
Safe deposit rental	10 00	
Livery	5 00	
Counterfeit money	7 00	
Telegraphing	16 77	
Telephone service	470 41	$31,051 49
Pumping Water Account—		
Engineers and firemen	$16,571 59	
Consulting engineer	1,200 00	

Fuel oil	$29,392 38	
Coal	72 05	
Printing, telegraphing and stationery	24 15	
Supplies—rags, waste, soap, etc	288 18	
Supplies—valves, gaskets, etc	280 99	
Boiler and machine repairs	135 71	
Lubricants	251 43	
Tools and repairing of	115 45	
Medical attendance (injuries in 1892)	20 50	
Horse, harness, etc	57 55	
Feed, shoeing, etc	62 50	
Street car tickets	15 00	
Electric light, royalty and attachments	55 18	
		$48,463 46
WATER RATES ACCOUNT—		
Overcharge returned	$15 00	
		15 00
PERCENTAGE ACCOUNT—		
Labor	$1,847 50	
		1,847 50
REPAIRING LEAKS ACCOUNT.		
Labor	$8,548 99	
Wagon and harness repairs	128 85	
Feed and stabling	218 87	
Blankets	16 00	
Farrier	64 25	
Street car and toll tickets	100 00	
Repairing of tools	76 06	
Tools and materials	268 59	
Repairing pavement	21 44	
		9,443 05
SERVICE CONNECTIONS ACCOUNT—		
Labor and inspectors	$6,764 47	
Cart and harness repairs, blankets, etc	265 20	
Service cocks and valves	2,599 47	
Farrier	67 75	
Lap robes	27 00	
Tools and materials	459 01	
Feed	90 93	
Toll tickets	5 00	
		10,278 83
INSPECTION ACCOUNT—		
Labor	$3,240 00	
		3,240 00
Aggregate		$104,339 33

BONDED INDEBTEDNESS ACCOUNT.

Bonds paid	$71,000 00

INTEREST ACCOUNT.

Interest paid	$74,163 69

PARK AND BOULEVARD COMMISSION.

Laying submerged pipe across river to island	$8,886 22

HURLBUT FUND ACCOUNT.

Superintendent, librarian and labor	$3,899 51	
Plants, trees, flowers, fertilizers, etc	411 45	
Tools and materials	84 02	
Materials for greenhouse	243 09	
Horse, feed, etc	186 25	
Gravel	372 40	
Sewer pipe	47 71	
Fence	5,969 10	
Sidewalk	792 00	
Memorial gateway (part)	8,900 00	
Architect	1,142 03	
		$22,049 56

RECAPITULATION.

Construction expenditures	$378,048 94
Operation and maintenance expenditures	104,339 33
Bonded indebtedness	71,000 00
Interest	74,163 69
Park and Boulevard Commission	8,886 22
Hurlbut fund	22,049 56
Aggregate	$658,487 74

RECEIPTS OF WATER RATES BY DISTRICTS.

YEAR.	1st District Wards 9 and 15.	2d District, Wards 11 and 13.	3d District, Wards 1 and 7.	4th District, Wards 3 and 5.	5th District, Wards 2 and 6.	6th District, Wards 10 and 14.	7th District, Wards 4 and 12.	8th District, Wards 8 and 16.	Meters.	Aggregate.
1882-3	....	....	$7 00	....	....	....	....	....	....	$7 00
1883-4	....	....	7 00	....	....	....	....	....	....	7 00
1884-5	....	....	7 00	....	$7 00	....	....	....	....	14 00
1885-6	....	....	7 00	....	7 00	....	....	....	....	14 00
1886-7	....	....	5 00	....	7 00	....	....	....	....	12 00
1887-8	....	....	5 00	....	23 00	....	....	....	....	28 00
1888-9	....	....	5 00	$5 00	7 00	....	$159 98	....	....	176 98
1889-90	....	....	13 00	146 90	9 75	....	74 85	....	....	244 50
1890-1	....	....	5 00	239 80	34 00	$6 00	91 25	....	....	376 05
1891-2	....	$2 50	37 25	121 13	60 25	39 25	38 00	$69 50	....	367 88
1892-3	$19,950 31	16,985 78	23,562 37	21,431 39	25,725 87	18,716 46	22,560 94	18,481 42	$34,989 53	202,404 07
1893-4	24,081 69	18,197 92	24,962 03	22,239 62	27,412 07	19,483 51	23,829 25	19,586 92	37,046 34	216,839 35
Total..	$44,032 00	$35,186 20	$48,622 65	$44,183 84	$53,292 94	$38,245 22	$46,754 27	$38,137 84	$72,035 87	$420,490 83

To the Board of Water Commissioners:

GENTLEMEN — In accordance with the regulations of the Board we have employed J. H. Clegg, expert accountant, to make a thorough examination of the financial operations of the employees of the Board, both in the receiving and paying out of money, from the date of the last investigation up to January 1, 1894, and append herewith his report.

Yours respectfully,
(Signed) H. M. DUFFIELD,
J. L. HUDSON,
Committee on Ways and Means.

DETROIT, MICH., January 31, 1894.

To the Committee on Ways and Means, Board of Water Commissioners, City of Detroit:

GENTLEMEN — As instructed by your committee, I have examined the books and vouchers of the Water Works for the remainder of the year ending December 30, 1893. My report of September 5, 1893, covered the examination of the Secretary, Receiving Clerk, and Permit Clerk to May 1, 1893, the Meter Department to January 1, 1893, and the Assessors and Collectors to July 1st, 1893.

The examination just concluded covers all the officials above named from the respective dates, excepting the Assessors and Collectors.

I did not go into the details of the Assessors' and Collectors' accounts, for the reason that I consider the system of checks now in use to be a sufficient protection until the end of the assessment year (June 30, 1894), when their work can be proven. I did, however, inspect each stub book, and saw that each and all were properly certified as being correctly footed and posted by officials of other districts or departments.

I carefully examined the accounts of the Secretary, and found properly approved vouchers for all disbursements, and said disbursements were correctly charged to the various accounts.

The Receiving Clerk has accounted for all moneys paid to him, and his cash and bank balances as shown I verified and found correct.

The accounts of the Meter and Permit Clerks are also correct.

CASH STATEMENT.

Jan. 1, 1893,	cash on hand	$4,106 63	
	Commercial National Bank, General Fund	119,249 24	
	Commercial National Bank, Sinking Fund	48,896 15	
Cash receipts, 1893		524,934 42	
			$697,186 44
Disbursements, 1893		$658,487 74	
Jan. 1, 1894,	cash on hand	4,748 48	
	Commercial National Bank, balance,	33,450 22	
	Secretary's Fund	500 00	
			$697,186 44

Respectfully submitted.

(Signed) JOHN H. CLEGG,
Accountant.

The actual operating and maintenance expenses for the year were $97,246.68, and is arrived at as follows:

Office		$31,051 49
Pumping water		48,463 46
Water rates		15 00
Percentage	$1,847 50	
By fines collected	443 50	
		1,404 00
Repairing leaks	$9,443 05	
By labor paid	33 50	
		9,409 55
Service cocks	$10,278 83	
By labor and material paid for	6,615 65	
		3,663 18
Inspection		3,240 00
		$97,246 68

The above figures are taken also for the actual operating expenses, less the sum expended in the employment of expert accountants during the past year, and which practically had nothing to do with the operation or running of the works. This sum was $5,215.28, leaving the operation expense $92,031.40.

Attached herewith is an inventory of all the properties of the Board.

Some interesting facts may be deduced therefrom, as follows:

The entire expense for construction up to Jan. 1, 1894, is	$5,569,631 68
The present indebtedness	1,158,000 00
Paid for	$4,411,631 68
The present valuation of the works, as per inventory, is	4,601,349 50
Showing a depreciation of	968,282 13

All of which is respectfully submitted.

L. N. CASE,
General Superintendent.

VALUATION OF THE WORKS.

AGGREGATES.

Real estate	$412,427 29
Oil plant	14,649 29
Buildings, docks, basins, conduits, force mains at pumping works	853,602 69
Water pipe laid and in use	3,162,077 52
Meters placed and in use	77,571 87
TOOLS AND MATERIALS ON HAND.	
Office furniture and fixtures	7,758 90
In repair department	1,292 81
In meter department	1,827 59
In service cocks department	1,554 75
In iron pipe department	39,787 05
In pumping water and works department	24,582 06
In Hurlbut Fund department	617 73
Horses, vehicles and harness	3,600 00
Aggregate	$4,601,349 55

The above valuation consists in detail as follows:

REAL ESTATE.

Office building and lot	$60,000 00	
Orleans street lots	33,750 00	
Storage grounds and improvements	47,200 00	
Pumping works grounds and improvements	271,477 29	
		$412,427 29

OIL PLANT.

Pumping station house, engines and pipes, tanks and fixtures at works	$14,649 29

PUMPING WORKS.

Buildings, dock, basin, conduits, pipe, etc.	$853,602 69	
Tools	1,011 83	
Materials: Rope, waste, etc.	500 29	
" Gauges, valves, etc.	814 80	
" Iron, lead, etc.	720 25	
Furniture	356 00	
Wood and coal	14,879 10	
Fuel oil (145,056 gals.)	2,226 87	
Hoisting engines, pony pumps and boilers, electric light plant and stock, gas machine, etc.	4,072 92	
Tools and materials—Hurlbut Fund	617 73	
		$878,802 48

OFFICE BUILDING.

Counter	in office	$1,000 00
Fourteen office tables	" "	215 00
Six book cases	" "	660 00
Three wardrobes	" "	335 00
Seven desks	" "	200 00
Thirty-six chairs	" "	91 50
Thirteen office stools	" "	45 00
Eight city maps	" "	20 00
One marble clock	" "	100 00
Four atlas maps	" "	100 00
Partitions and railings	" "	800 00
Heating apparatus	" "	1,400 00
Electric light fixtures	" "	55 00
Miscellaneous properties	" "	100 00
Furniture in board room		575 00
4 Stools,	in drafting room	12 00
4 Drafting tables,	" " "	50 00
3 " " and horses,	" " "	26 00
2 " boards,	" " "	2 00
1 Blue print outfit,	" " "	25 74
1 Case instruments,	" " "	60 00
2½ Rolls blue print paper,	" " "	18 70
6 Rolls velum,	" " "	46 20
5 Tee squares,	" " "	6 25

2	Straight edges,	in drafting room........	$2 00	
2	Tape lines,	" " "	2 25	
1	Roll drawing paper,	" " "	5 00	
2	Readers,	" " "	2 35	
1	Desk and chair and stool,	Engineer's room....	40 25	
1	Table,	" "	27 00	
1	Drafting table,	" "	15 00	
5	Chairs,	" "	15 00	
1	Washstand,	" "	26 66	
3	Desks,	Supt. of Ex. room,	40 00	
2	Tables,	" "	5 00	
2	Pigeon hole cases,	" "	3 00	
1	Case for maps and drawings,	" "	1,500 00	
1	Copy press books and stand,	" "	10 00	
1	Safe, hat rack, 8 chairs,	" "	36 50	
1	Case for filing reports, etc.,	" "	25 00	
3	Galv. boxes and 6 tin boxes,	" "	3 50	
	Mucilage, ink, etc., and wells,	" "	7 50	
	Blanks, stationery, etc.,	" "	50 00	
				$7,758 90

REPAIR DEPARTMENT.

1	set caulking tools.......................	$1 50
150	lbs. pig lead............................	6 00
63	lbs. sheet lead..........	3 31
180	lbs. 1¼ in. lead pipe.....................	9 00
43	lbs. 1 in. lead pipe......................	2 15
118	lbs. ⅝ in. lead pipe......................	5 90
11	ladles	16 50
2	fire pots................................	12 00
1	dozen diamond pointed chisels............	12 00
5	flat chisels.............................	2 50
1	anvil....................................	2 50
2	vises....................................	8 00
19	gate keys................................	26 25
15	street keys..............................	15 00
3	pumps	120 00
5	pressure gauges..........................	12 00
11	hydrant wrenches.........................	5 50
10	dippers..................................	5 00
12	pairs rubber boots.......................	48 00
2	leather coats............................	9 00

5 shovels	$3 75
3 picks	4 50
5 pounders	5 00
5 pounder handles	1 00
13 lanterns	6 50
2 saws	1 25
1 draw knife	50
1 log rimmer	1 75
1 stop box	1 25
1 platform scale	25 00
2 force pumps	8 00
1 grindstone	1 25
3 water pails	50
70 feet ⅝ in. hose	7 00
3 pick handles	24
2 sledges	2 40
1 8 in. bolted sleeve, 150 lbs. at 2$\frac{1}{10}$ cts	3 15
1 6 in. " 96 " "	2 02
10 4 in. " 537 " "	11 28
8 4 in. " 160 " "	3 36
3 3 in. " 39 " "	82
2 3 in. sleeves, 65 lbs. at 2$\frac{1}{10}$ cts	1 37
1 6 in. " 71 " "	1 50
1 8 in. " 84 " "	1 76
1 4 in. " 53 " "	1 11
1 4 in. bend, 55 " "	1 16
1 3 in. " 43 " "	90
6 4 in. gate stems (O'Brien's)	7 50
6 6 in. " "	10 50
6 4 in. " (Murdock)	10 50
5 6 in. " "	12 00
5 4 in. " (Flowers)	15 00
5 6 in. " "	20 00
1 8 in. valve and nut	14 45
1 4 in. valve and top (Flowers)	7 70
1 6 in. " " (Murdock)	10 45
1 6 in. " " (Flowers)	10 45
1 4 in. " " (Murdock)	7 70
1 6 in. valve and nut (O'Brien	8 85
4 6 in. stuffing boxes (Murdock)	65
2 4 in. " " "	90
4 4 in. " " (O'Brien)	1 80
6 6 in. " " "	4 50

2 6 in. caps, 77 lbs. at $2\frac{1}{10}$ cts.		$1 62	
1 3 in. cap, 19 " "		40	
1 4 in. cap, 30 " "		63	
2 prong keys		2 50	
3 crow bars		3 30	
1 machine for raising gate boxes		7 50	
18 red lantern globes		9 00	
2 white lantern globes		20	
4 axe handles		40	
15 lbs. solder		1 88	
			$1,292 81

SERVICE COCKS.

1 2x4 Smith sleeve and valve		$9 00	
1 3x4 " " " "		10 00	
1 2x6 " " " "		11 50	
1 3x6 " " " "		12 50	
1 4x6 " " " "		16 00	
1 2x8 " " " "		12 00	
1 3x8 " " " "		14 00	
1 4x8 " " " "		18 00	
1 2x10 " " " "		16 00	
1 3x10 " " " "		18 00	
1 4x10 " " " "		22 00	
2 pairs rubber boots	at $4 00	8 00	
2 leather jackets	4 00	8 00	
273 1 in. service cocks, at 90c.		245 70	
303 ¾ in. " , at 45c.		136 35	
1 Smith tapping machine		350 00	
3 Mueller "	at $85 00	255 00	
1 30 in. saddle	1 00	1 00	
2 24 in. "	1 00	2 00	
2 16 in. "	1 00	2 00	
2 12 in. "	1 00	2 00	
3 10 in. "	1 00	3 00	
3 8 in. "	1 00	3 00	
3 6 in. "	1 00	3 00	
3 4 in. "	1 00	3 00	
3 3 in. "	1 00	3 00	
6 yokes	1 75	10 50	
3 pressure wrenches	50	1 50	
3 handles for turning taps	2 00	6 00	
8 1 in. drills and taps	3 00	24 00	
10 ¾ in. " " "	2 00	20 00	

3	¾ in. drills and taps	$2 50	$7 50	
3	¾ in. taps	90	2 70	
2	½ in. taps and drills	2 00	4 00	
1	emery wheel and spindle		3 40	
8	oil cans	10	80	
2	monkey wrenches	60	1 20	
1	Stilson wrench		3 00	
8	hooks and slides	3 00	24 00	
127	drills (old)	30	38 10	
3	drilling ratchets	5 00	15 00	
2	horse blankets		9 00	
				$1,554 75

METERS.

57	meters	$1,161 00
1	foot lathe	90 00
1	water motor	50 00
	Lathe chucks, turning tools, etc	13 22
1	stock and dies, ratchet stock, dies and gas taps	33 25
4	pipe cutters and wheels	43 50
14	Stilson monkey and S wrenches	18 10
2	sets caulking tools and hammers	4 35
1	pair snips	2 50
6	pairs pipe and chain tongs	12 50
3	vises	13 75
1	washer cutter	75
5	chisels	1 50
2	hollow punches	1 50
1	steel bar	1 50
6	files	1 32
6	gate keys	9 50
1	nail puller	1 25
1	seal punch and lead seals	4 00
2	chain and rope tackle	13 00
1	pair boots	1 00
3	oil cans	1 50
2	testing tanks	16 50
4	saws	6 00
2	axes and jack plane	1 50
1	extension bit and cutter	1 70
	Saw set, square and auger	2 25
4	fire pots and ladles	24 75
6	bailing dippers	6 00
4	hand pumps and valves	9 70

8	lanterns (1 electric)	$14 35	
	Blankets, robes and brush	10 50	
	Sun shade for wagon	3 00	
29	tees	2 48	
97	nipples	9 08	
65	bushings	2 26	
30	reducers	1 90	
55	couplings	3 12	
54	unions	7 70	
204	ells	15 16	
128	meter couplings	31 35	
21	valves (check)	20 23	
1	4-in. gate valve	5 50	
301	lbs. lead pipe	13 04	
56	lbs. wiping solder and half and half	6 80	
6	bars tin	1 44	
31	lbs. brass castings	7 75	
21	small boxes for meters	8 10	
	Lockers, shelving, benches, etc.	15 00	
	Lumber	23 00	
	Flange bolts	8 14	
	Iron covers	47 25	
	Gas pipe, etc	17 02	
	Miscellaneous articles	6 03	
			$1,827 59

IRON PIPE DEPARTMENT.

PIPE IN GROUND.

103	feet	45	in. pipe	$1,699 50	
45,127	"	42	"	658,996 40	
715	"	36	"	6,587 35	
49,337	"	30	"	322,404 86	
84,813	"	24	"	403,704 93	
461	"	20	"	1,751 80	
87	"	18	"	278 40	
36,777	"	16	"	110,469 78	
8,444	"	12	"	16,556 38	
114,509	"	10	"	174,790 29	
219,795	"	8	"	250,841 58	
917,408	"	6	"	649,018 93	
831,348	"	4	"	526,750 94	
76,302	"	3	"	37,474 28	
2,820	"	2	"	752 10	
					3,162,077 52
2,388,046	total feet.				

STOCK AT RESERVOIR.

Iron pipe	$23,957 98	
Specials	5,931 16	
Gates and valves	1,850 31	
Gate boxes	777 48	
Gate well covers	646 80	
Lead	2,466 05	
Packing	67 95	
Oil	3 60	
Coal	9 72	
Scrap iron	1,600 00	
Tools	989 74	
Covers and blankets for horses	30 00	
Materials, lumber, cement, etc	1,456 26	
		$39,787 05

HORSES AND WAGONS.

1 horse, phaeton, sleigh and harness—Office	$305 00	
1 horse, cart, etc., and harness—Pumping Works	125 00	
1 horse, carriage, wagon and harness—Meter	429 00	
4 horses, 4 wagons and harness—Rep'g Leaks.	762 00	
2 horses, 2 wagons and harness—Service Cocks	464 00	
4 horses, 3 trucks and harness—Iron Pipe	1,330 00	
1 horse, 1 cart and harness—Hurlbut Fund	185 00	
		3,600 00
Aggregate		$4,601,349 55

REPORT OF THE CIVIL ENGINEER.

JANUARY 25, 1894.

To the Honorable Board of Water Commissioners of the City of Detroit:

GENTLEMEN—Conforming to the regulations of your Honorable Body, the Civil Engineer submits for your consideration the following report of the operations under his supervision during the year just past.

The most important subject receiving attention thus far has been the equalization and increase of pressure in our system. Until very recently the works of this city have been operated with a pressure as low as the lowest in any city of the United States. A low pressure is economical as far as the expense of operation is concerned, for the fuel consumed, other things being equal, will vary with the head pumped against, and if there be waste, it will increase as the pressure increases, though not in the same ratio. But the pressure maintained on our system appears to have been too low to satisfy the demands of our population for several years past, and what has been available has been very unfortunately distributed; while the residents in the southwest portion of the city had an abundant supply, those living in the upper Woodward and Cass Avenue district were oftentimes unable to get water into second-story bath-rooms.

Owing to the many complaints of deficient pressure, your Secretary, in July, 1891, through the courtesy of the Fire Commission, had placed in various fire engine houses about the city, pressure gauges, from which readings have been recorded every hour to the present time. For the first month the recorded pressures at the several locations were found to vary from 11.9 pounds, the lowest, to 26.9, the highest, with an average from the entire city, deduced from these readings, and the areas of the districts which they represent of 18.02 pounds. In September of the same year this last average pressure had fallen to 16.9 pounds. During the colder months, as seen by Plate 3, page 51, it recovered itself somewhat, but in August, 1892, it had fallen to 15.4 pounds, and in January, 1893, to 15 pounds. During the eighteen months intervening between the location of the gauges and this last date, your Secretary had endeavored, by throttling certain lines, to correct the evils, and would doubtless have been successful to a considerable degree, had it not been that the extensions then under construction, were so designed as to counteract any beneficial results that were obtained. As it was, his efforts served to keep the pressure in certain localities from falling to the very unsatisfactory point it must otherwise have reached.

The Civil Engineer's connection with these works dates from the middle of last February, and at that time the study of this problem was turned over to him. Pressure readings were at once taken at ninety-seven points about the system, which are recorded in the table on page 61. A study of the topography of the city revealed that within the limits supplied by the system there is a difference of elevation of more than fifty feet, which amounts to a difference of pressure of about twenty-two pounds. In most systems this would be comparatively insignificant, so far as domestic service is concerned, but owing to the very low pressure maintained here it was of vital importance. From the fact that this low pressure, originally determined by the limited head attainable with the old reservoir system, had been adhered to for so long a time, the plumbing in our city was of a very light character in many places, and a material increase of pressure would be attended by serious breakage. Consequently when the growth of the town demanded a higher head in certain localities than could be obtained from the reservoir, and direct pumping was resorted to, the system was divided into an upper and a lower service. On the upper service about nine pounds more pressure was maintained at the engines than on the lower, and by this means it was intended to carry a very nearly uniform pressure throughout the city, as, if the flow of water were properly adjusted, there need not have been a variation of more than twelve pounds between any points of the system. From the fact that it was primarily the elevation of the ground which necessitated the adoption of this arrangement, it was to be supposed that the topography of the city would be a subject of very careful consideration in connection with the development of the plan, but actually it appears to have been entirely overlooked, for although this plan was adopted in 1886, and has been operated upon ever since, there was not to be found in the current records of the Construction Department, an elevation of a single point in the entire system at the beginning of last March. The Secretary, however, had on file in his office, the elevations of the several gauges he had located, and the records of the readings for the twenty months preceding. This information was turned over to the writer, and formed the nucleus about which the material was gathered which forms the bulk of this report.

Referring to the map of the system, opposite page 60, it will be seen that the supply from the pumping station reaches the business district through a 42-inch main in Jefferson Avenue, while the supply for the northern portion of the city flows through a similar main on Cadillac Boulevard and Mack Avenue, and thence *via* Collins Street and Canfield Avenue, traverses almost the highest district in the city. Passing westward along this line it will be seen that it connects with a 24-inch main running south in Vinewood Avenue. The designer, or, more properly, the developer of the system apparently at this point lost sight of two very important principles in hydraulics; first, that friction increases with the length of the channel; and, second, that water runs down hill. Had the situation been properly studied it would have appeared that instead of laying this main in Vinewood Avenue, a much more direct and level route would be obtained by connecting with some one of the down town mains to supply the southwestern district. The elevation of the corner of Vinewood

Avenue and Fort Street is only a few feet above the pumping station, as will be seen from the map, and the water traversing the Canfield Avenue main must pass over a hight of some fifty feet to arrive at an elevation of less than fifteen feet, while by extending one of the mains, as referred to above, an almost level route would have been obtained. Aside from the cost of elevating the water to the hight necessary for it to flow over the hill, the loss of head due to friction was fully fifty *per cent.* more by the circuitous route selected than it would have been by the other, and worse than all by the syphonic action of the water used in the low lands on that flowing over the hill, the pressure in the upper districts was very materially reduced, at some points fully thirty *per cent.*

It is a well known principle of hydraulics that if water flows in a tube from a higher to a lower level, whatever the path of the tube—if friction be not considered—the pressure at any point will be measured by the ordinate from the tube to the straight line joining the ends of it, so that if at any point the tube crosses this line the pressure there becomes zero and above the line a suction will exist. So in such a case if water be flowing under pressure in a pipe from a point A to a point C and there is a point B between the two at the same level as A, it will not have the same pressure as A because of the syphonic action of the water flowing away at C. This is just the condition which was produced by the above-described construction. The consumption of water in the low western part of town caused the pressure along Woodward and Cass Avenues to fall to less than three-fourths what it would have been had the water been consumed at that level instead of at the lower one.

Another error in the arrangement was in the treatment of the locality along Gratiot Avenue from Hastings Street north and east. This territory, it will be seen by the contour lines on the map, lies in almost the highest district in the city, but it was being supplied from the lower service, and the pressures obtainable were often insufficient for the needs of the manufacturing establishments there. Appeals from property owners had been answered by the laying of more and larger pipe, and the Superintendent had each time reported that the static head was very materially improved, but the record of pressure in that locality shows that the head obstinately decreased from 15.2 pounds in July, 1891, to 12.5 pounds in March, 1893. To remedy this last evil involved only the readjustment of the distribution in existing mains by the manipulation of the gates. This was accomplished at the end of March, and the April record showed the district to have more than recovered its lost pressure, the average being 16.6 pounds. The section in the northern part of the city required more heroic treatment, for before the difficulty there could be remedied, a new means of supplying the western part of town had to be devised. So, absurd as it may seem, a line of pipe was laid out Michigan Avenue to afford better pressure to the residents in the upper Woodward Avenue district.

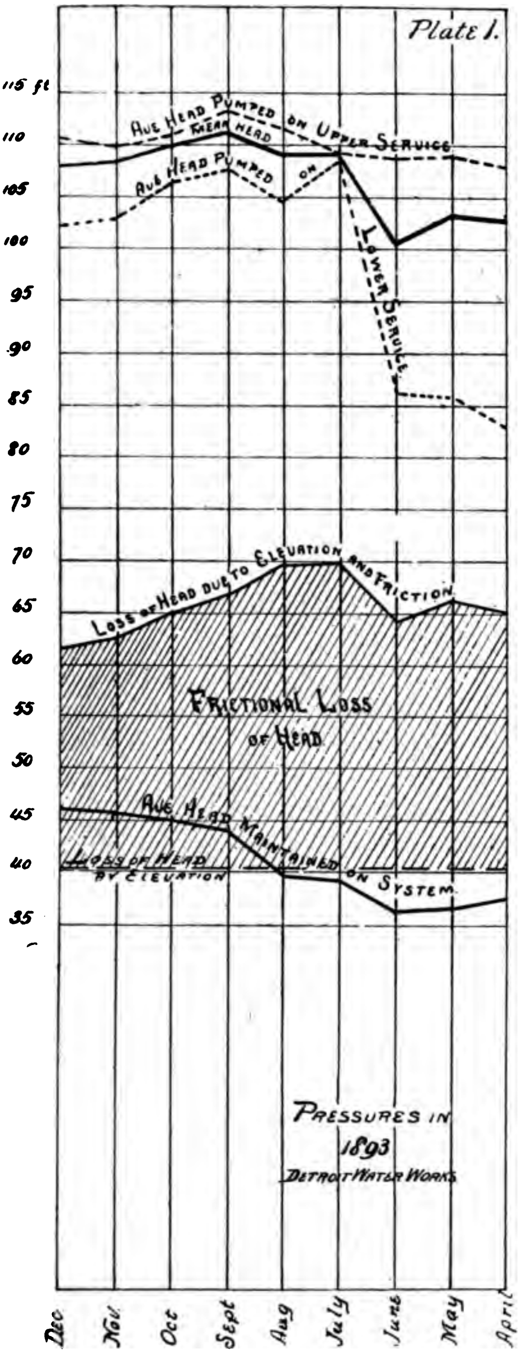
Referring again to the map, it will be seen that the 130-ft. contour line, which runs from the city limits, near Wreford Street, on the west, nearly parallel with Grand River Avenue, to Bagg Street, and thence, by an easy curve, eastward, crossing Woodward Avenue near High Street, and Chene Street at Mullett Street, divides the system about equally, both as to elevation and area, and it will be further noted, that the 120-ft. line divides the lower half about equally. The 130-ft. line is the one naturally selected as the division line of the upper and lower services, and the 120-ft. line, passing, as it does, very nearly along Abbott and Tenth Streets and Michigan Avenue, led to the selection of the latter route as the line of supply for the western district. During the month of June, before this line was completed, on account of many complaints in the northern part of the city, it became necessary to cut off the western district from the Canfield Avenue main, and to supply it through the Bagg Street main. To do this, the pressure on the low service system was raised sufficiently to supply the Gratiot Avenue territory, and the supply to the central portion of town was throttled to avoid excessive pressure. Under these conditions the system was operated from June 20 to

August 4, and the results are tabulated under the head of July. At the end of this time the Michigan Avenue line was completed and opened, when the system was readjusted to accord with the new condition. During the temporary July arrangement, it was incidentally demonstrated that while leading into the business portion of town there are two 30-inch mains, one 24-inch, one 16-inch, and one 12-inch main, the entire supply required for this portion of the city during these forty-five days, could be brought through one 30-inch main, with a gate in it closed to within one-fourth of the bottom of its opening. It therefore appears that the center of town is abundantly supplied with large pipe.

Upon the completion of the Michigan Avenue line, our attention was chiefly devoted to the construction of a 10-inch main along the eastern river front, for the better fire protection of the large manufacturing interests in that vicinity. This line was connected with the Jefferson Avenue 42-inch main at the corner of Meldrum Avenue, and thence was laid south on Meldrum Avenue to Wight Street, and thence, *via* Wight Street, McDougall Avenue and Guoin Street, connected to the old 8-inch main in Orleans Street, a 6-inch cross line being added on Adair Street, from Jefferson Avenue to the river. By the readjustment of the system the Bagg Street line was shut off at Grand River Avenue, and in order that the portion of the line west of this point, with the Fifteenth Street and Buchanan Street lines, might be used as a main artery for the lower service, the old 16-inch line in Miami Avenue and Park Street was extended from Washington Avenue up Park Street to Columbia Street, thence *via* Columbia, Cass, Gilman, Cherry and Sixth Streets, to connect with the Bagg Street line. This work was completed October 17, and finished the construction in connection with the readjustment of the system for this year.

As to the results obtained by these operations we may state broadly that so far as we know, since the first of September we have been able to supply to all of our consumers as great a quantity of water, and at as high a pressure, as they have demanded, and we are equally well satisfied that it is at least several years since this condition existed before. To consider the subject more specifically, attention is first invited to Plate 1, on page 48, which shows the pressure record of the system for the last nine months of 1893. It is to be regretted that the records of the works do not furnish the data for extending the chart back further than the month of April, but, strange as it may seem, until that month there was no record kept of the head pumped against at the pumping station, and while the duty of the engines was figured on the basis of a head of 116 feet, it does not, in the light of the information embodied in Plates 1 and 2, seem possible that the mean pressure could ever have reached that point; for as shown on Plate 4, the quantity of water pumped the past year was greater than that pumped any preceding year except 1888, and the work done by the system as a whole has been decidedly greater than appears before while the average mean head at the engines has not exceeded 113 feet for any month. That such an immense gain in the efficiency of the system has been achieved, as can be proven if this old record is correct, is a claim that our regard for probability prevents us from maintaining.

The three lines at the top of Plate 1 represent the heads against which the engines worked, the full line being the mean head of the two systems. The lowest jagged line of the diagram shows the average pressure for each month on the distribution system as determined by readings on eleven gauges, taken hourly, as also were those at the pumping station, from which the upper lines were constructed. The difference between this last line and the line of mean head at the engines represents the amount of work expended in attaining the elevations of the various points in our system and in overcoming the friction in the pipe. These quantities have been plotted for the several months and give the line near the middle of the diagram. This amount of pressure is lost so far as obtaining work from it is concerned. A part of it, that expended in overcoming the elevation, represented by the ordinates below the line at 40.4 feet, cannot be reduced or



changed; but that part due to friction, represented by the ordinates of the shaded area will change from various causes. For instance, the frictional resistances increase with the velocity of flow, hence with the quantity of water pumped, and they also increase with the length of the pipe and the number and sharpness of bends. It appears from the diagram that the frictional loss in July was greater than it was in May or June because of the increased quantity of water pumped, but in August, though more water was pumped than in July, the frictional loss was less on account of the more economical adjustment of the system which was then being brought about, and the frictional loss has undergone a steady decrease since that time. In September it was 13 *per cent.* less than in July, though 3 *per cent.* more

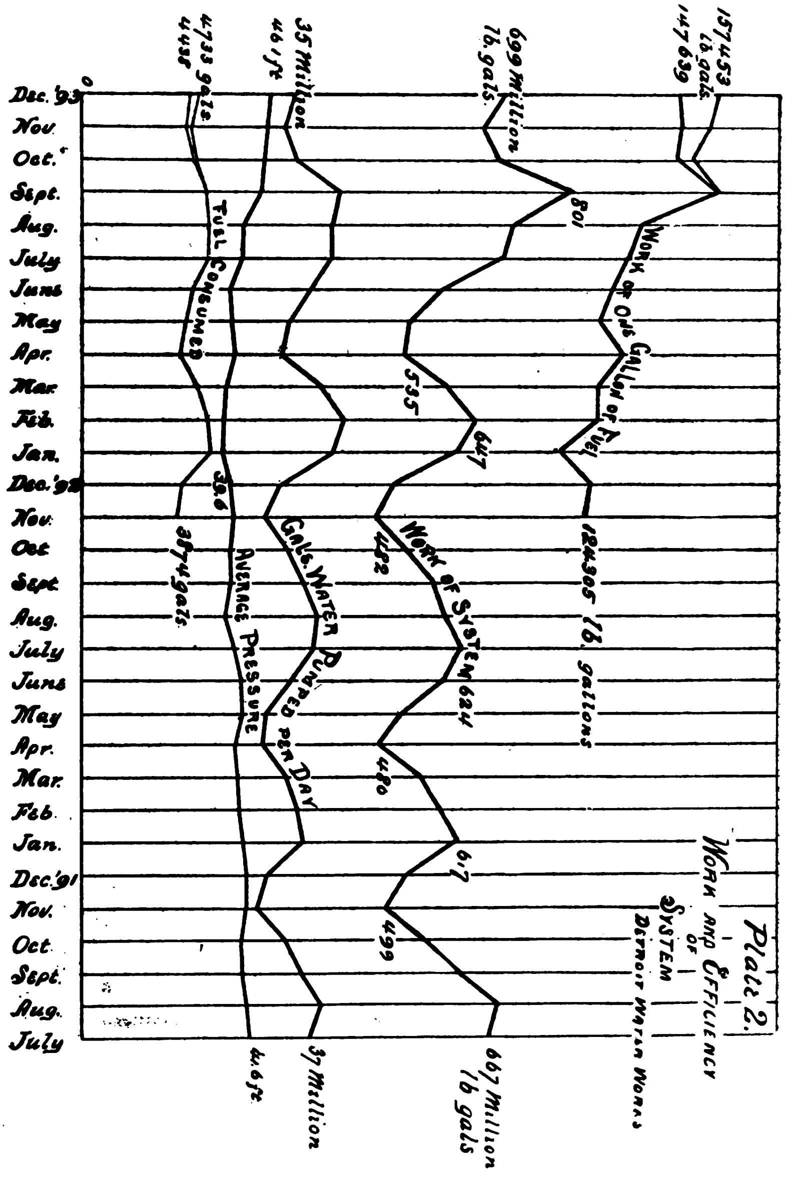


Plate 2.
Work and Efficiency of System Detroit Water Works
Dec. '93
Nov.
Oct.
Sept.
Aug.
July
June
May
Apr.
Mar.
Feb.
Jan.
Dec. '92
Nov.
Oct.
Sept.
Aug.
July
June
May
Apr.
Mar.
Feb.
Jan.
Dec. '91
Nov.
Oct.
Sept.
Aug.
July
0
4733 gals.
4438
46 ft
35 Million
699 Million lb. gals.
157453 lb. gals.
147639
801
535
647
482
624
480
617
499
38.6
3874 gals.
124305 lb. gallons
Fuel Consumed
Work of One Gallon of Fuel
Work of System
Gals. Water Pumped per Day
Average Pressure
46 ft
37 Million
667 Million lb gals

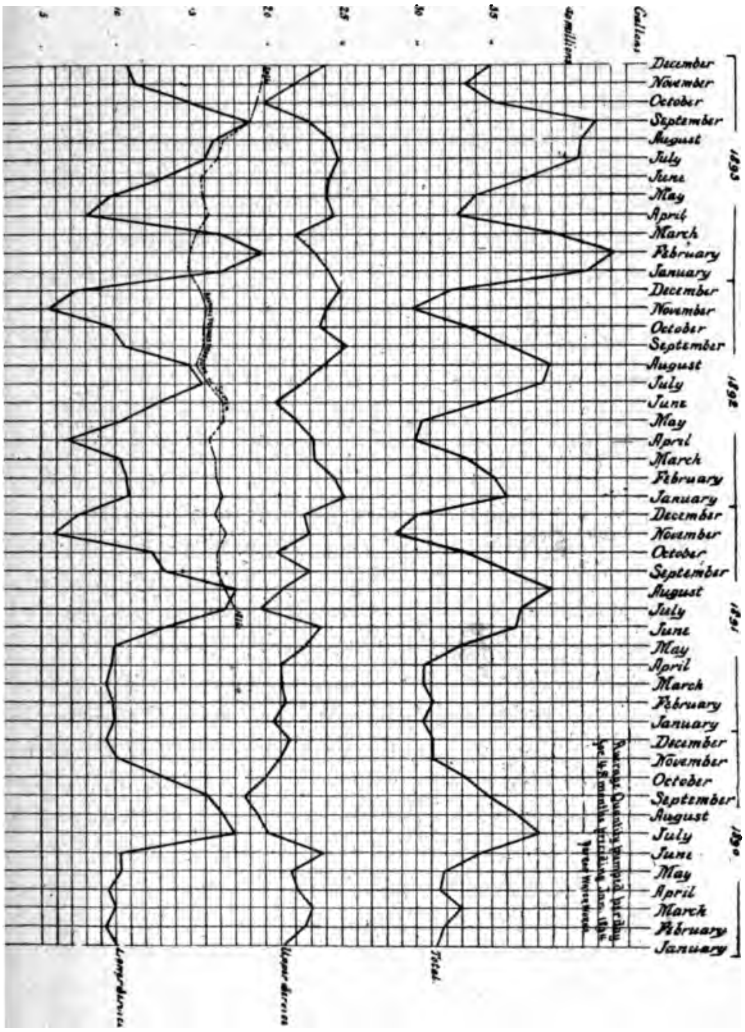
water was pumped. When it is remembered that any decrease in the loss of head means a corresponding decrease in the quantity of fuel consumed to maintain a given available pressure on the system, the importance of this subject will be appreciated. Comparing again the line of mean head at the pumping station with the line of average head on the system it will be seen that the latter has steadily increased since June, while the former has been decreasing since September. Here again comes in the item of cost, and it appears that we are giving our consumers 12 *per cent.* more pressure than we were able to give in July under the best arrangement we could devise and are pumping against a head only 92 *per cent.* as great.

We now leave the work of the engines as a separate factor and referring to Plate 2, page 49, we consider the system as a whole.

Beginning at the bottom of the diagram, we have first the fuel consumed each month since we have burned oil exclusively; second, the average pressures maintained on the system since July, 1891, the date of the establishment of the pressure gauges; third, the average number of gallons of water pumped per day; fourth, the available work of the system, *i. e.*, the product of the gallons pumped per day multiplied by the pressure maintained on the system, which product is designated pound-gallons; and fifth, we have the available work done by one gallon of oil, also in pound-gallons.

It is at once seen that there was less fuel burned in September than in July, although there was more water pumped in September, and, owing to the increased pressure, vastly more work done. From September it will be seen that the fuel line divides. The upper branch representing the total fuel consumed, including that for heating buildings, etc., as well as pumping, while the lower branch represents the quantity used for pumping alone. Comparing now December, 1892, with December, 1893, we find that in December, 1892, 4,041 gallons of oil per day pumped 32,375,098 gallons of water, giving a pressure on the system of 15.69 pounds; and in December, 1893, making no correction for heating buildings, although the space

eated was fully 30 *per cent.* greater, we find that 4,733 g
f oil pumped 35,026,431 gallons of water, giving a pı
f 19.95 pounds, or referring to the top line of the diagram, ne gallon of oil did 125,703 pound-gallons of work in 1892, nd 147,639 pound-gallons of work in 1893, showing a gain of ver 17 *per cent.* which is a decrease in the cost of operation.



The upper line shows the fluctuations of the amount of work done by one gallon of oil since November, 1892, the lower branch being computed on the basis of the total fuel consumption and the upper one on the basis of the fuel actually used for pumping, and whichever line we choose to consider shows a marked improvement over the conditions of one year ago, or even of the first half of this year.

Turning now to Plate 3, which shows the quantity of water pumped in the upper and lower systems separately, and in the two combined by the upmost line, it is interesting to note that the total consumption has two maxima and two minima in the year. The first maximum is usually reached in January or February, and is due to the waste of water to prevent connections freezing; and the second occurs usually in August, and is due to the use of water on account of the hot weather. The minima occur about April and November, at which times there is the least demand for water on either of the above accounts. It is to be noted that the daily quantity of water allowed to run to waste in February of the past year exceeded that consumed in lawn sprinkling and other extraordinary uses during the hot months. In the dotted line of this diagram is again shown the variations of the average pressure since July, 1891, whence it appears that from a pressure of 18 pounds at that date, it continued generally to decrease until it reached its minimum in January and February, 1893, notwithstanding the efforts being put forth to recover it. In March, under the effects of a decreasing consumption, it began to recover slightly, and in April reached a temporary maximum, on account of the small quantity pumped and the partial readjustment of the old system. It fell with the increased pumping in May and June until the temporary arrangement before described was effected in July, since which time it has been steadily increasing, and this with the same engine and boilers at the pumping station which were, under former conditions, reported worked far beyond their capacity in 1891.

The average pressure on our system in December was, according to the eleven permanent gauges, 19.95 pounds. The record of pressures from 97 hydrants on single readings, taken in November and December, shows the average of the system to be 24.16 pounds as compared with an average of 18.87 pounds for the same hydrants in March, and the average of 173 hydrants taken in November and December, and recorded in the column headed "December, 1893," on page 61, gives an average pressure of 24.41 pounds for the system, which is probably a very close approximation to the conditions. The greatest proportional gain noted in any one locality was at the corner of Kirby and Trumbull avenues, where the pressure had increased from 10 pounds in March to 19½ pounds in December, a gain of 95 *per cent.*

In the adjustments of the pressures and the distribution of the supply, we have endeavored to maintain the proposition that every citizen of Detroit is entitled to as much water at our hands as he is willing to pay for, and that he is entitled to it at the same pressure as his neighbor. While the contour of the ground will prevent the full realization of the latter part of the proposition, it may reasonably be expected that henceforth we will be able to supply fixtures on the third floor of any building within the city limits.

In Plate 4 we show the number of families supplied, the quantity of water consumed and the amount of pipe in service for each year from 1853 to 1893, inclusive. This information is interesting, as showing that while the first and the last items have maintained about the same relation to each other for forty years, the water consumption has increased much more rapidly than either. In the compilation of this data, the actual number of families supplied—counting each hotel as one family—is taken, excluding all mercantile and manufacturing establishments, it being satisfactorily proven that the consumption in such lines does not affect the family consumption, for if one such establishment is a necessary adjunct of a population of one hundred families, a similar establishment will be a necessary adjunct of every other one hundred families. This is not a theory, but was proven by your Secretary in his annual report for 1892.

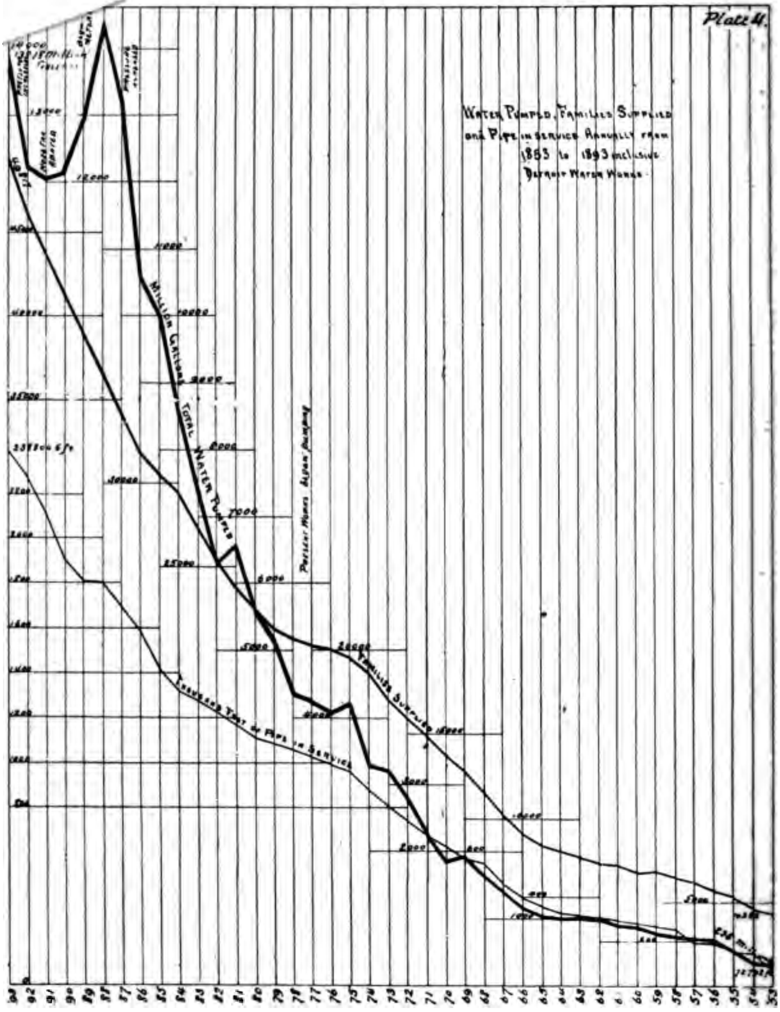
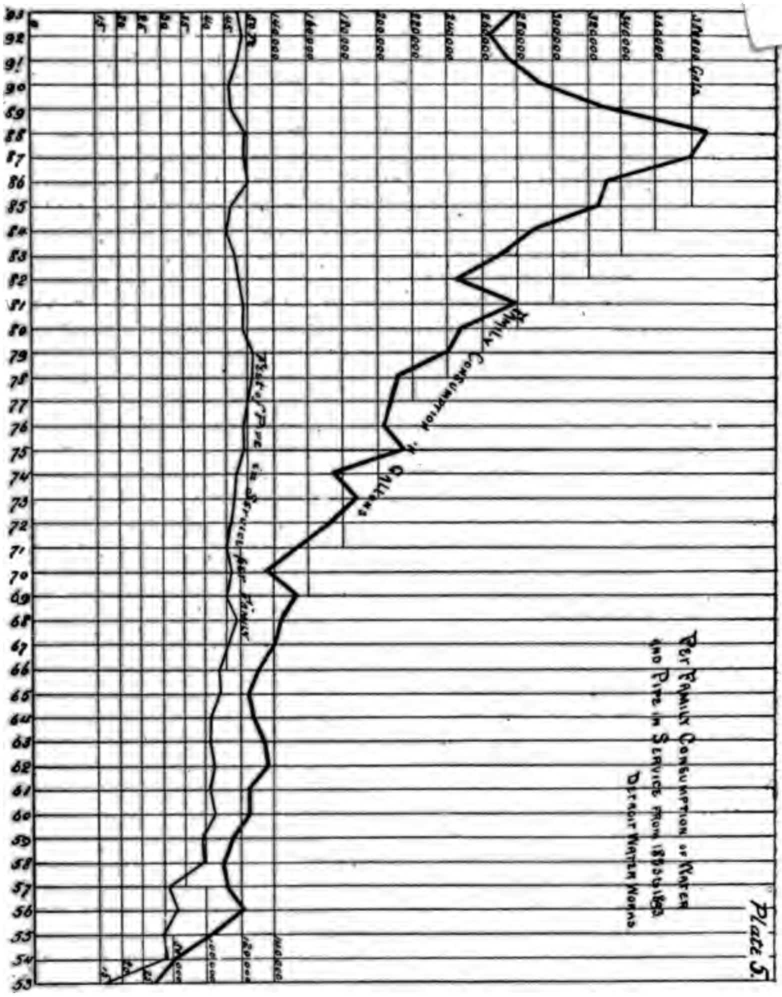


Plate 5 shows more clearly the annual increase of consumption per family, and also the feet of pipe in service per family, which latter has not varied ten feet since 1860, and having its maximum of 51 feet in 1878, has for 1893 fallen to 48 feet, thus showing that our distribution is becoming more concentrated.

We now come to the consideration of another very impor-



Per Family Consumption of Water and Pipe in Service from 1853 to 1893. Detroit Water Works.

Plate 5.

tant subject, that of Waste. The total average waste of water in our system, from the best information obtained as yet, appears to be about 60 *per cent.* of the entire quantity pumped. This, in this system as in any other, can be considered in two parts, which must be treated separately in any plan for its curtailment. The first portion to be dealt with, and the one most frequently receiving attention, is that due to the carelessness of man in handling the fixtures on his own premises; while the second comprises that due to defective construction. The former may be restricted in various ways, and its amount will vary greatly from time to time, but other things being the same, will increase with the population. The most satisfactory method of dealing with this part of the problem, is undoubtedly the meter system, and our consumers are many of them to be congratulated for not being required to pay the cost of what other persons use. The second part of the problem does not admit of so easy a solution. The waste due to defective construction will be changed only by variations of pressure and an increase or decrease of such construction. When we see that in our system there are about 430 miles of pipe that has never been tested in the sight of man, and that this means about 200,000 joints of all sizes, which, if reduced to equivalent four-inch joints, would be 411,000 that may be leaking for all any person knows, we must appreciate the probability of a very large part of our leakage being found here. During the past season, under the writer's immediate supervision, there have been taken up or uncovered in our system about three miles of pipe and in this the proportion of leaking joints was about 60 *per cent.* of the whole number uncovered. Everywhere was found evidence of the most careless work. Many joints appeared never to have been driven at all, and in others only the top was tooled. The latter was the case with a joint uncovered in a 42-inch main which must have been leaking for sixteen years, and had finally caused a settlement of the street car track for a space fully fifty feet in length. As there has not yet been devised any means of telling whether a joint is tight except to try it, it was recommended to require all joints to be tested in the open ditch under as high a pressure as may be available, and to be carefully inspected under pressure after they have been tested for some hours. This recommendation was approved by your Honorable Body, and has been strictly adhered to on that part of the work under the writer's charge, but it seems to have been treated with considerable indifference in other extensions. The remedy of defects in the old work will require so large an expenditure that it does not seem likely ever to be considered except in specific cases where the leak is known positively to exist.

Another source of immense loss is the old-fashioned corporation cocks which were driven with a hammer into a hole drilled in the pipe with an ordinary ratchet and drill. The weight of the earth piled above, usually was sufficient to so loosen the cocks as to cause a continuous flow from them. This system of tapping became obsolete in most cities twenty years ago, and was superseded by the tapping machine which drills and threads a hole and screws a cock into it, making a perfectly tight connection without wasting more than a pint of water, although worked against a pressure of 160 pounds. The latter method was recommended to your Honorable Body and adopted in May last, and has since been in very satisfactory operation.

From the number of broken gates reported in our system and the leakage around the gate stems, it was considered advisable to construct around all gates in paved streets permanent wells of sufficient size to admit a man, so as to afford easy access in making necessary repairs. The advantages of this plan have had abundant proof even in the very short time it has been in vogue. During the year there have been constructed 639 such wells at a total cost of $14,399.95, of which 480 were in old work and cost $10,990.07, and 159 were in connection with new lines and cost $3,409.88.

In addition to the previously described construction, a line of 10-inch pipe has been laid under the writer's supervision across the channel to supply Belle Isle Park. While this work has not yet been completed, the pipe has been successfully laid in place by the contractor.

On April 19 last, a fire broke out at the Kling Brewery, situated near the corner of Jefferson and Field Avenues, which developed one of the most serious minor defects of our system. It appears to have been the practice heretofore to lay large and small supply mains through districts they were intended to supply without connecting them to the cross lines.

From this defect a very serious loss was only averted by the good judgment of one of the Fire Department officials, who stationed two of the engines to take water from the river, while the other three actually pumped dry that portion of the city between Jefferson and Mack Avenues east of the Belt Line Railroad. An investigation revealed that there was in Jefferson Avenue a 6-inch main laid parallel with the 42-inch, but only connected to it at points 5,100 feet apart, and that the district north was supplied entirely from this 6-inch main, and all hydrants were connected with it. Your Honorable Body at once adopted the recommendation that cross-connections be put in at intermediate points, which work has been successfully accomplished without shutting off the water in the 42-inch main, and without any special machinery, by a contrivance of the writer's, the saving per connection over the Smith sleeve being about $175 for 6-inch, and $200 for 10-inch connections. That similar conditions exist elsewhere in our system is demonstrated by the records recently compiled in the draughting room, which, in maps showing 1,131 intersecting lines, reveal that 172, or over 15 *per cent.* of them, are not connected, and sixteen connections of old lines have been made this season.

The cost and extent of the various construction under your Civil Engineer's supervision has been as follows:

Michigan Avenue Line—	
9,414 feet 24-in. pipe and 84 feet 16-in. pipe	$44,333 99
Meldrum, Wight, McDougall, Guoin and Adair St. Line—	
7,370 feet 10-in. pipe and 1,248 feet 6-in. pipe	12,028 99
Park Street Line—	
4,496 feet 16-in. pipe and 1,650 feet 12-in. pipe	20,378 17
Jefferson Avenue Cross-Connections—	
2 10-in. and 8 6-in. connections	1,893 30
Belle Isle River Crossing—	
3,550 feet 10-in. pipe to date	9,683 22
Work at Pumping Station, remodeling coal sheds and clearing canal bank	840 56
Making a total of	$89,158 23

The only line likely to come under the head of extraordinary construction during the ensuing year is the one already endorsed by your Honorable Body, to be laid across town at about the locality of Farnsworth Street, the estimates for which are $55,000. The matter of a sufficient and effective means of removing from our system the accumulations of the past forty years is at present also under consideration. To correct an erroneous impression often voiced in the daily press regarding the efficacy of a settling basin in reducing the sediment in our water, it may be stated that in the periods of maximum demand the settling basin is emptied about twice every twenty-four hours, and about one and a half times in the periods of minimum consumption.

In August last the draughting room and records of the Iron Pipe Department were placed under the control of the Civil Engineer. Previous to that time the records of the department comprised an outline map of the entire city to a scale of 300 feet to the inch and memorandum records of pipe laid, journalized without drawings. Under the instructions of your Honorable Body the services of Mr. Clarence W. Hubbell were engaged as chief draughtsman, who assumed those duties September first and from whose report the following is abstracted :

The force in the draughting room has consisted, since September 1, of the Chief Draughtsman and two assistants with the services of a third a part of the time. One complete set of small scale city maps have been kept corrected up to date, and the compilation and preparation of a complete and intelligent record of the pipeage system has been commenced. For the latter it is contemplated to made a plat of each street and alley intersection, showing the location of all specials, gates, pipe and any other information of value. These plats are about 20x21 inches in size and are drawn to a scale of eight feet to the inch. When completed there will be about 8,000 tracings arranged in north and south streets, and 8,000 blue prints of the same arranged in east and west streets. On September 1, there were on hand 128 tracings and about 900 pencil drawings of intersections. All of the former have been corrected to date and two hundred of the latter have been traced and corrected, so that with new work we now have 788 new tracings, 128 old tracings, 205 new pencil drawings and 700 old pencil drawings, a total of 1,821 street and alley intersections. Excluding the 700 old pencil drawings not yet corrected, we have 1,121 plats brought up to date, covering 1,131 intersecting lines. In making this record every available source of information has been utilized, and while a perfect record is not possible under the circumstances, there being no serviceable record earlier than 1877 other than the annual report, it is expected that one as near the ideal as possible, and in convenient form for reference, will ultimately be obtained.

In closing this report it gives me more than ordinary pleasure to speak of the many very valuable suggestions and the hearty co-operation received at the hands of the Chief Engineer and his assistants at the pumping station, and much of the advantage of the present system of operation as deduced in this report is to be credited to the very skillful management of that part of the plant. The debt that is owed by our citizens to your Secretary must not be passed over without remark. That a man without special engineering training should have come to a conception, and so near to a correction of the evils of this system, where men of professed training in engineering lines had failed, is a matter of surprise and a cause for congratulation. Without the efforts which he put forth, the condition of a part of our city must have been serious indeed during the latter part of 1892.

This report is, gentlemen, very respectfully submitted.

G. S. WILLIAMS,
Civil Engineer.

HYDRANT AND ENGINE HOUSE PRESSURES.

north and south streets are arranged alphabetically in the first s. The east and west streets are arranged to read from south to Locations in small capitals are Permanent Gauges.

LOCATION.		Lbs. Pressure. 1893.		Feet Head. 1893.	
treets.	Cross Streets.	Mar.	Dec.	Mar.	Dec.
....	Fort..........	20.0	25.0	46.2	57.8
	Dix...........	24 0	28.0	55.4	64.7
....	Brady........	14 0	18.5	32 3	42.7
	Canfield......	11.0	20.0	25 4	46.2
	Boulevard....	15.0	19.0	34.6	43.9
l E....	Jefferson......	....	31.0	....	71.6
l W...	Fort..........	23.0	26.5	53.1	61.2
	Michigan.....	21.0	24.0	48.5	55.4
	Grand River..	16.0	19.5	37.0	45.0
....	Watson.......	14.0	21.0	32.3	48.5
....	Jefferson.....	37.0	37.0	62.4	62.4
	Farrand......	....	40.0	....	92.4
....	Jefferson.....	....	31.0	....	71.6
	Congress......	....	31.0	....	71.6
	Bagg..........	17.0	24.0	39.3	55.4
	Brainard......	15.0	22.0	34.7	50.8
	ALEXANDRINE.	14.7	20 0	34.0	46.2
	Canfield......	16.0	21.0	37.0	48.5
	Kirby.........	12.0	17.5	27.7	40.4
	AMSTERDAM...	....	15.4	....	35.6
....	Congress.....	22.0	28.0	50.8	64.7
	Mullett.......	15.0	22.0	34 7	50.8
	Chestnut.....	13 0	22.0	30.0	50.8
	Scott.........	11.0	21.0	25.4	48 5
	St. Joseph....	12.0	22.0	27.7	50.8
	Canfield......	17.0	19.0	39.3	43.9
	Ferry.........	14.0	17.0	32.3	39.3
....	Columbia.....	18.0	26.0	41.6	60.1
....	Gratiot.......	20.0	23.0	46.2	53.1
	Canfield......	18 0	21.0	41.6	48.5
	Ferry.........	16 0	19 0	37.0	43.9
	Medbury......	15.0	19.0	34.7	43.9
vealth	Grand River..	18.0	25.0	41.6	57.8
....	CONGRESS.....	....	30.4	....	70.2
....	Jefferson.....	....	35.0	....	80.9
	Mack.........	....	32.0	....	73.9
....	Bagg..........	16.0	24.0	37.0	55.4
	Tuscola.......	16.0	25.0	37.0	57.8
	Brigham......	13.0	26.0	30.0	60.1
	Putnam.......	....	19.0	....	43 9
	Kirby........	11.0	17.5	25.4	40.4
	Boulevard....	....	16 5	....	38.1
	Fourth........	....	16.5	....	38.1

LOCATION.		Lbs. Pressure. 1893.		Feet Head. 1893.	
N. & S. Streets.	Cross Streets.	Mar.	Dec.	Mar.	Dec.
Elmwood......	FORT..........	18.8	20.7	43.4	47.8
	Sherman......	....	22.0	....	50 8
	Waterloo.....	....	23.0	....	53.1
Field..........	Champlain....	....	29.0	....	67.0
	Mack..........	25.0	27.0	57.8	62 4
	Gratiot........	....	26.0	....	60.1
Fifth..........	Plum..........	18.0	26.0	41.6	60.1
Fifteenth......	Fort..........	23.0	27.0	53.1	62.4
	Baker.........	....	25.0	....	57.8
	Michigan......	. ..	25.0	....	57.8
	Bagg..........	18.0	24.0	41.6	55.4
	Butternut....	19.0	24.0	43.9	55.4
	Magnolia.....	17.0	25.0	39.3	57.8
	Buchanan....	16.0	25.0	37.0	57.8
Fisher.........	Jefferson......	....	35.0	....	80.9
Fourteenth....	Hudson.......	15.0	20.0	34.7	46.2
	Boulevard....	13.0	18.0	30.0	41.6
Grandy........	GRATIOT......	12.5	19.9	28.9	46.0
Griswold.......	CLIFFORD.....	....	26.9	....	62.1
Hastings......	Atwater.......	....	36.5	....	84.3
	Jefferson......	....	26 0	....	60.1
	Congress......	....	30.0	....	69.3
	CONGRESS.....	...	26 8	....	61.9
	Champlain....	....	26.0	....	60 1
	Columbia.....	19.0	22.0	43.9	50.8
	Watson.......	14.0	20.0	32.3	46.2
Hubbard.......	FORT..........	24.1	26.3	55.7	60.8
Humboldt.....	Myrtle........	20.0	22 0	46.2	50.8
	Buchanan....	17.0	22.0	39.3	50.8
Jos. Campau..	Guoin.........	....	35.0	....	80.9
	Jefferson......	....	29.0	....	67.0
Lafferty.......	Fort..........	20.0	27.0	46 2	62.4
Leib...........	Wight.........	....	33.0	....	76.2
Livernois......	Toledo........	....	26.0	....	60.1
	Stark........	24 0	26.0	55.4	60.1
	Buchanan....	23.0	27.0	53.1	62.4
McClellan......	Farrand.......	....	35.0	....	80.9
	Mack..........	....	34.0	...	78 5
	Gratiot........	....	31 0	....	71.6
McDougall.....	Monroe......	20.0	23.0	46.2	53 1

HYDRANT AND ENGINE-HOUSE PRESSURES—*Continued.*

LOCATION.		Lbs. Pressure.		Feet Head.	
		1893.		1893.	
N. & S. Streets.	Cross Streets.	Mar.	Dec.	Mar.	Dec.
McKinstry	Toledo	....	24.5	....	56.6
Meldrum	Wight	....	32.5	....	75.1
	Jefferson	23.0	28.0	53.1	64.7
	Congress	23.0	27.0	53.1	62.4
Mt. Elliott	Champlain	....	32.0	....	73.9
	Waterloo	....	25 0	....	57.8
	Mack	....	23.0	....	53 1
	SYLVESTER	....	....	....	....
	Gratiot	....	23.0	....	53.1
Orleans	Guoin	....	37.5	....	86 6
	Jefferson	....	29.0	....	67.0
	Champlain	....	25.0	....	57.8
	Mullett	19.0	27.0	43.9	62 4
	Scott	12.0	19.0	27.7	43.9
Randolph	JEFFERSON	21.0	26.0	48.5	60.1
	Jefferson	...	27.0	....	62.4
	Congress	23.0	31.0	53.1	71.6
Raynor	Gratiot	20.0	22.0	46.2	50 8
Riopelle	Mullett	20.0	28.0	46.2	64.7
Russell	Gratiot	15.0	20.0	34.7	46.2
	Montcalm	15.0	20.0	34.7	46 2
	HIGH	13.5	18.3	31.2	42.3
	Watson	14.0	19.5	32.3	45.0
	CALHOUN	....	17.6	....	40.7
	Indiana	15.0	19 0	34.6	43.9
	Canfield	15.0	19 0	34.6	43.9
	FERRY	9.6	12.5	22.2	28.9
	Ferry	14.0	16.0	32.3	37.0
Scotten	MICHIGAN	21.7	23.5	50.1	54.3
Second	Grand River	....	24.5	....	56.6
	Bagg	17.0	24.0	39.3	55.4
Seventh	Fort	....	28.0	....	64.7
Sixth	Congress	....	32.0	....	73 9
	BAKER	17.4	25.4	40.2	58 7
Sixteenth	BAGG	16.0	24.7	37.0	57.1
	GRAND RIVER	13.8	16.9	31.9	39.0
St. Antoine	Winder	....	20.0	....	46.2
	Watson	....	20 0	....	46 2
	Indiana	....	19.0	....	43.9
	Theodore	....	18.0	....	41.6
	Ferry	....	18.0	....	41.6
	Harper	....	17.0	....	39.3
St. Aubin	Guoin	....	36.0	....	83.2
	Congress	24.0	28 0	55-4	64.7
	Mullett	....	22.5	....	52 0
	Antietam	....	21.0	....	48 5
	Brewster	....	20.0	....	46 2
	Hale	....	19.5	....	45.0
	Illinois	11.0	20.0	25.4	46.2
	Canfield	....	21.0	....	48 5
	Forest	....	20.0	....	46 2
	Farnsworth	....	20 0	....	46.2
	Ferry	....	19.0	....	43.9
	Boulevard	....	19.0	....	43.9
Sullivan	Magnolia	19.0	22.0	43.9	50.8
	Grand River	15 0	20.0	34.7	46.2
Tenth	Abbott	19.0	26 0	43.9	60.1
	Michigan	....	24.5	....	56 6
Third	Jefferson	....	36.0	....	83.2
	Congress	....	31 0	....	71.6
	Michigan	19 0	27.0	43.9	62 4
	Canfield	16 0	22.0	37.0	50 8
	Kirby	12.0	17 5	27.7	40.4
Thirteenth	Grand River	15 0	23.0	34 7	53.1
Tillman	Warren	....	21.5	....	49 7
	Stanley	14.0	18.0	32.3	41.6
Trumbull	Michigan	19.0	26 0	43.9	60.1
	Bagg	17.0	23.0	39 3	53.1
	Brigham	13.0	22 5	30 0	52 0
	Kirby	10.0	19 5	23 1	45 0
	Holden	....	18.0	....	41.6
Twelfth	Magnolia	17.0	22 0	39.3	50.8
Twentieth	Howard	22 0	25.0	50.8	57 8
	Standish	....	24.0	....	55.4
	ROSE	....	25 5	....	58.9
	MICHIGAN	....	24.5	....	56.6
Twenty-first	Dalzelle	19 0	24.0	43.9	55.4
Twenty-fourth	Dalzelle	20.0	24 0	46 2	55.4
	Butternut	21.0	24 0	48.5	55.4
Twenty-ninth	Buchanan	20 0	25 0	46 2	57.8
Van Dyke	Jefferson	...	33.0	....	76 2
	Walnut	....	31 0		71 6
	Mack	...	30 0	...	69.3
	Gratiot	...	28 0	..	64.7
Vinewood	Fort	22.0	26.0	50 8	60.1
	Porter	....	27.5	....	63 5
	Toledo	20.0	25.0	46 2	57.8
	A Street	21.0	25 0	48 5	57.8
	Magnolia	21.0	25.0	48.5	57.8
	Buchanan	21 0	24.0	48 5	55.4
Wabash	Dalzelle	20.0	25.0	46 2	57 8
Wayne	LARNED	....	32.2	....	74 4
Woodward	Atwater	....	35.5	....	81.0
	Jefferson	....	28.0	....	64.7
	Congress	....	31.0	....	71 6
	Michigan	....	27.0	....	62.4
	Park	....	27 0	....	62 4
	Columbia	18.0	26.0	41.6	60.1
	High	....	25 0	....	57 8
	Bagg	16 0	21.5	37 0	49.7
	Parsons	18 0	23.5	41 6	54.3
	Canfield	16.0	20 5	37.0	47.4
	Farnsworth	....	18.5	....	42.7
	Ferry	14.0	18 0	....	41.6
	Piquette	....	17 5	....	40.4
	Boulevard	....	17 0	....	39 3
	Holbrook	....	16 5	....	38 1
	Englewood	....	15.0	....	34.7

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

DETROIT, January 2, 1894.

To the Board of Water Commissioners:

GENTLEMEN—In compliance with the rules of your honorable body, I herewith report the work done in the Meter, Inspection and Service Cocks Departments during the year 1893.

The following tables show the number of meters placed, the number removed, and the total number in service on the 31st day of December, 1893:

Placed in 1893.

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Total number placed during the year 1893	334	151	97	17	21	4	4	......	628

Removed in 1893.

	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Service connections discontinued	32	3	7	1	1	1	......	45
Premises vacant	4	......	10	2	1	......	......	17
For repairs, and replaced with other meters	7	2	10	1	1	1	......	22
Too small for required supply	2	......	1	......	......	......	......	3
Too large for required supply	......	......	10	4	1	......	......	15
Total number removed	45	5	38	8	4	2		102

Meters in Service Jan. 1, 1894.

	SIZES.								
	5/8 in.	3/4 in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
In service Jan. 1, 1893	923	405	466	76	102	57	22	2	2,053
Placed during the year, and in service Jan. 1, 1894	289	146	59	9	17	2	4	......	526
Total number in service Jan. 1, 1894	1212	551	525	85	119	59	26	2	2,579

The following tables show the kind and sizes of meters placed during the year, also those removed:

Placed in 1893.

KIND.	SIZES.							
	5/8 in.	3/4 in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Thomson	296	149	89	13	19	2	3	571
Crown	4	......	2	2	......	1	......	9
Hersey	......	......	3	2	1	1	1	8
Worthington	6	2	1	......	......	......	......	9
Neptune	26	......	1	......	1	......	......	28
Union Duplex	......	......	1	......	......	......	......	1
Union Rotary	2	......	......	......	......	......	......	2
	334	151	97	17	21	4	4	628

Removed in 1893.

KIND.	SIZES.							
	5/8 in.	3/4 in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Thomson	35	3	21	2	3	1	......	65
Crown	3	1	4	2	......	......	......	10
Hersey	1	1	9	3	......	......	......	14
Worthington	5	......	2	1	1	1	......	10
Union Rotary	......	......	1	......	......	......	......	1
Neptune	1	......	......	......	......	......	......	1
Union Duplex	......	......	1	......	......	......	......	1
	45	5	38	8	4	2	......	1 02

The following table shows the total number of meters in service and the different kinds and sizes, also indicators attached to hydraulic elevators:

In Service Jan. 1, 1894.

KIND.	SIZES.									
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Indi-cat'rs	Total
Thomson	1,119	529	418	68	79	38	10	2		2,263
Crown	40	15	46	11	13	9	4			138
Hersey	2	3	38	1	13	2	8			67
Worthington	15	4	17	2	12	9	3			62
Union Rotary	11		1	2	2	1	1			18
Neptune	25		1		1					27
Duplex			2							2
Equitable			1							1
Ball & Fitts			1							1
Indicators									9	9
Total No. in use Jan. 1, 1894	1,212	551	525	84	120	59	26	2	9	2,588

Meters in Stock.

KIND.	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Thomson	13	1	5	6	2	2	1	30
Crown		1	2	1				4
Hersey		1	10	2				13
Worthington			1		1			2
Union Rotary			6					6
Neptune	2							2
	15	3	24	9	3	2	1	57

Tools and Materials on hand.

Valuation of meters in stock, January 1, 1894	**$1,161 00**
Valuation of material on hand, January 1, 1894	**252 35**
Valuation of tools, January 1, 1894	**401 24**
Valuation of horses, wagons, etc., January 1, 1894	**442 00**
	$2,256 59

Meters in Service.

Valuation of meters in service, Jan. 1, 1893.....	$68,733 99	
Deduct 10 per cent. for depreciation in value....	6,873 39	
		$61,860 60
Add amount expended during the year for meters placed..................................	$18,753 16	
Less amount received for meters sold to Park Commissioners...........................	785 30	
		17,967 86
		$79,828 46
Less stock on hand, January 1, 1894........................		2,256 59
Total valuation of meters in service, January 1, 1894.......		$77,571 87
Cost of material used in repairing meters in 1893...........		38 11
Cost of labor in repairing meters in 1893....................		649 50
Total cost of repairs for 1893........................		$687 61

Summary of total amount expended in the meter department for the years 1889 to 1893, inclusive:

	1889	1890	1891	1892	1893	Aggregate
Meters	$11,175 00	$18,700 00	$6,501 55	$12,371 82	$6,987 43	$55,735 80
Supt. and labor......	1,734 10	8,510 57	4,841 49	8,269 17	8,980 48	32,335 81
Material, tools, etc..	637 26	2,982 14	872 99	2,132 93	1,650 33	8,275 65
Freight, hauling, etc	98 05	408 97	197 11	244 08	165 12	1,118 33
Horse, wagons, etc..	....	....	....	547 24	184 50	731 74
Total	$13,644 41	$30,601 68	$12,413 14	$23,565 24	$17,967 86	$98,192 33

In presenting this report to your honorable body, I am pleased to say that the affairs in the Meter Department have moved along during the past year very satisfactorily, and without any material change from former years. We have placed 526 meters, making the total number now in use, 2,579.

Nothing has transpired that tends to shake our faith in the wisdom shown in adopting the meter system four years ago.

There has been a great change in the minds of water takers since the meter system was first adopted. At that time almost every person was afraid that their rates would be increased by the use of a meter, so much so, that some of them, on the first indication that we contemplated placing a meter on their premises, would rush to the office and pay six months' or a year's rates in advance at the estimated assessment, rather than take the chance of paying by meter rates. One party, who had been paying $60 per year on his factory, when he saw us preparing to meter his premises, hurried to the office and paid six months' rates, $30, in advance, and went away gloating over the idea of his shrewdness. Nevertheless we placed the meter, and at the end of six months found that he had used just $12 worth of water, for which he had paid $30, but he considered it such a good joke on himself that he never applied for a rebate. Such instances go to prove that the meter is much more accurate than an estimator in arriving at the quantity of water consumed. But, as I said before, the minds of water takers have changed in a great degree, as the larger proportion of meters placed now are on the premises of those who apply for them, as they prefer paying by meter rather than the estimated rate (one hundred and fifty of such applications having been received during the past six months). There are some who object to the paying of their meter rates monthly, especially the small consumers, claiming that they ought not to be obliged to come to the office every month to pay the small sum of seventy-five cents, that being the minimum rate, and an amount which a considerable number pay. It is possible that it would be advisable to make a rule allowing all bills below a fixed amount to be paid quarterly, and above that amount monthly. In any event it would be necessary to read the meters each month as a matter of protection to the consumer as well as that of the meter, inasmuch as leaks are continually occurring which increase the consumption unnecessarily, and sometimes to a large amount, and by a monthly reading consumers are made aware of the fact, and can make the necessary repairs, so that the next month's consumption will only amount to the legitimate uses, whereas, if meters were allowed to go three months without reading, it would often make the consumer pay for a large quantity, of which the greater portion would be waste. Even with monthly readings, all consumers should learn to read their meters, and by so doing would detect leaks whenever they occur, as an undue consumption would immediately lead to an investigation. If all large consumers would read their meters each day, it would insure them against paying any large amount for waste, something that has occurred at different times in the past. In some cases forty or fifty dollars have been paid in one month for waste alone, when, if the register of the meter had been taken each day, nearly the whole amount could have been saved to the consumer.

The cost of repairing meters has increased during the past year, owing to the increased number in use, and also to the fact of the last winter being a very severe one. We had quite a large number frozen, but were able to repair very nearly all of them, the cost of which was principally for labor only, as the material required was trifling. We have thirty of the smaller sizes, mostly $\frac{5}{8}$-inch, which we are unable to repair. They are an accumulation of four years, and to send them to the factory for repairs would cost more than we are now paying for new meters, which, if frozen, we can repair ourselves, without any more cost than that of labor, a fact that has saved us in the past, and will continue to save in the future, a large amount in repairs. Meters are supposed to be placed where there is no danger of frost, but after all of our precautions they do not all escape, because the frost often catches the service pipe, several feet from the meter, and will follow along the pipe until it eventually reaches it. Sometimes they are frozen through the carelessness of the occupant, who leaves the cellar window or door open, and exposes the meter, but where it is clearly the fault of the occupant, our rules now provide that he shall pay the cost of repairs. Of the 2,579 meters in service, 712 of them are in pits outside of the buildings, and protected with iron covers, none of which have ever been frozen.

In compliance with a resolution of your honorable body requiring meters to be placed on some of the public school buildings, police stations, and fire engine houses as a matter of information to know about the quantity of water that is being furnished to said institutions, I have had meters placed on three school buildings, two police stations and two engine houses with the following results :

The Cass School in four months consumed 936,100 cubic feet, equal to 7,020,750 gallons and the average attendance being 942 makes an average daily consumption of 62 gallons per capita, or in other words about two barrels per day for each attendant. The Bishop School with an average attendance of 1,015 consumed in the same length of time 435,200 cubic feet, or 3,264,000 gallons, being an average daily consumption of 27 gallons per capita, or not quite half as much as the Cass School, while the Barstow School with an average attendance of 465 consumed 18,400 cubic feet, or 138,000 gallons, being an average of 2½ gallons per capita daily. The latter building is provided with the "dry closets" which, I presume accounts for the small consumption in comparison with the others. The enormous consumption at the Cass shows that we were correct in claiming that a very large and needless waste is continually going on in some, if not all, of the school buildings. Taking the three buildings as an average and we have a consumption of between two and three hundred million gallons per year, and at one-third of a cent per 100 gallons would amount to over $7,000, while we are collecting from the Board of Education for water used in public schools $1,071. I have no doubt but the amount paid is ample for all legitimate uses, and I also think that when the proper authorities are shown the large waste that is going on in the schools throughout the city, that they will take the necessary means to largely reduce it.

The Central Police Station consumed 100,400 cubic feet in four months or at the rate of 301,200 cubic feet per year, which at one-third of a cent. per 100 gallons would amount to $70.30, while their estimated assessment on the premises, and which they pay, is $70.00, showing the estimated and meter rate almost precisely the same. At the Woodbridge Street Station there was 24,900 cubic feet consumed in the same length of time, or at the rate of 74,700 cubic feet per year, and at the same rate per gallon would amount to $18.67, while they are paying a rate of $16.00 per year, showing also a very close comparison between meter and estimated rates. It is fair to presume that the eight remaining stations are paying about the same ratio of rates, which would prove very conclusively that there is not much waste taking place in that department, for which the officials in charge are entitled to credit.

The consumption of water in the engine houses (on which there is no assessment) is not large and shows that there is very little waste in that direction. Engine House No. 10 consumed 3,000 cubic feet in 40 days, and Engine House No. 11 consumed 5,500 cubic feet in the same length of time. If the foregoing is a fair average there would be consumed in the twenty-eight engine and truck houses something over 1,000,000 cubic feet per year, not a very exorbitant amount considering the number of persons employed therein, and also the horses, carriages, etc., that are cared for. It would show a very careful surveillance over the water fixtures throughout the buildings of the fire department, if the foregoing is a fair average, which I have no reason to doubt that it is.

INSPECTION.

No change in the working of this department has been made during the past year with the exception of the addition of one more examiner, making five in all. It is impossible for four men to get over the city twice each year, as so much of their time is taken up—about one-third—in reading meters and delivering meter bills, and as two examinations each year is absolutely necessary, I was obliged to ask for another examiner. With all the diligence shown, however, the percentage of leaks is increasing each year. In 1891 the percentage of leaks to number of examinations made was 4.77, in 1892, 6.63, and in 1893, 7.77. There is very little attention paid to the repairing of leaks by the majority of water takers until they are compelled to do so by a threat to shut off the water. In some instances leaks are going on without the knowledge of the occupant, who is first made aware of it by a notice from the examiner, but whether they know it or not it makes very little difference, for the repairs are seldom made until they get a peremptory notice to do so. This of course refers to unmetered connections, as there is no trouble to get repairs made on connections that are metered, unless it be that portion of the service pipe between the street main and the meter, for at that point the direct cost to the consumer is nothing, while it puts it upon the city at large, a fact that would lead to an indiscriminate and endless waste, were the individual consumers not held responsible for the water used on their premises. The increased pressure throughout the city during the past three years has undoubtedly had a great deal to do with the increased number of leaks, more particularly during the last season as the pressure has been increased very materially in a large portion of the city, the average being about five pounds. Previous to the year 1891 our rules allowed the use of lead service pipe known as "medium," which answered all purposes while the pressure remained as it did when the rule was adopted, but, as the leaks increased, we found it due in many cases to the lightness of the service pipe, and on January 1st, 1891, the Board adopted a rule allowing nothing lighter than pipe designated as "strong" which will undoubtedly be the means of preventing many leaks in the future ; but I anticipate numerous leaks and large waste while there remains so much "light"—as there seems to have been a time when any kind was allowed—and "medium" pipe throughout the city.

Another source of waste we have had to contend with during the past season was caused by many who allowed the water to run continually, claiming that they were ordered to do so by the Health Officer, and while there is no doubt many of them received such orders, many more made the same claim who had received no such notice, but in all cases our examiners notified them that no such permission had been granted by the Board of Water Commissioners, and until they were given such permission it could not be allowed, and as the necessity or advisability of such orders from the health officers was of a doubtful nature, the consumers, as far as we were able to judge, willingly complied with our notice to discontinue the practice.

The examiners made 55,086 examinations, reported 4,271 leaks, 3,984 of which were repaired on due notice being given, and 287 were ordered to be shut off for failure to make necessary repairs.

SERVICE CONNECTIONS.

On the first of last July, the Service Connections was transferred by the Secretary from the Iron Pipe to my department, and about the same time the mode of making such connections was changed also.

It has been evident for some time past that with the increased pressure added to our mains throughout the city, the time had come for the changing of the "drive cock" system to a more secure way of inserting them. They have been a source of a great deal of trouble on account of their liability to be blown out or become loose, causing numerous leaks and large waste, and thereby adding largely to the expense of the department of repairing leaks.

After consulting Secretary Case and myself, Civil Engineer Williams recommended to your honorable body the purchasing of three "Muehler Tapping Machines," the machines to cost $85 each, and with the necessary appliances—such as saddles, etc.—for operating the same, an additional cost of $25; making the total cost $280, to commence operation under the new system. As your honorable body complied with the recommendation, the machines were purchased and have been in operation since that time.

These machines drill the hole and insert the cock with a screw under pressure without the escape of any water whatever. Under the former system the tapper drilled the hole nearly through the pipe, then inserted the cock, and by giving it a sudden blow with the hammer would drive it into place, a small portion of the pipe breaking away and dropping inside. If by any chance, through a defect in pipe or otherwise, the cock did not fit properly, it would often blow out and deluge the tapper with water, besides causing much trouble, sometimes making it necessary to shut off the line before the connection could be made, something that cannot occur with the Muehler machine.

The cost of operating it is about the same as the old way, but there is a difference in the cost of the Muehler over the drive cock of 14 4-10 per cent, making the increased cost on total number inserted (1,900) up to January 1st, 1894, $151.24; a trifling amount when compared with the saving it will surely bring about in the future.

The Smith machine, purchased by the Board at a cost of $850, in the latter part of 1892, for making 2-in., 3-in., 4-in., and 6-in. connections under pressure, has proven itself to be all that the inventor claimed for it. It is a wonderful improvement over the old way of making such connections, and also saves a large amount of labor.

With this machine it is not necessary to shut off the street main when making a connection. The sleeve, with valve attached, is simply leaded around the pipe, the valve opened, when the drill passes through the valve, cuts a core from the pipe of the required size, withdraws said core back of the valve, which is then closed, when the core is removed and the connection is completed.

Formerly, in making a connection larger than 1 inch, the line of pipe on which such connection was made had to be shut off, and before doing so, each consumer on the line received a personal notice to that effect. That being done, the work of shutting off began, and it was necessary to shut all the way from two to ten gates—at one time seventeen—before the water was entirely shut off; then the hole was cut in the pipe. After that the water had to be removed, as usually the larger portion of the water in the district shut off had to be removed from the ditch before the joints could be leaded. And as it often happened a perfect shut-off could not be obtained—through defective gates—the labor of removing the water was increased, and the condition of the men when through was often deplorable. Then again, nearly all such connections had to be made in the night, thereby adding largely to the expense, as the district deprived of water usually included factories or some one who could not get along without water while the connection was being made, therefore making it necessary to do it after business hours, and often after 12 o'clock at night, as we never compelled factories to shut down or deprived large hotels, etc., of water until after that time, unless it was absolutely necessary. And again, in closing gates there is always a possibility of breaking them, something that has often occurred, and which has been very expensive, also. But all such difficulties and annoyances have been done away with by the use of the Smith machine. It has saved the Water Works much money, and also the tappers from many a cold bath during the time it has been in operation.

The total expense of the Service Cocks Department, including labor, material and inspection, amounts to $10,278.83. Of that amount, $3,912.50 should be deducted, as it represents the labor of the inspectors of new work, whose duties are principally confined to the inspection of plumbing and keeping the records of work done in that line throughout the city. The report of their work in detail is shown in a table following this statement of the service cocks proper, viz.:

Receipts for service cocks	$6,615 65	
Receipts for plumbers' licenses	635 00	
		$7,250 65
Total expense Service Cocks Department	$10,278 83	
Less labor of inspectors	3,912 50	
		$6.366 33
Balance to the credit of service cocks		$884 32

The following table shows the duties performed by the nspectors of new work during the year 1893:

INSPECTION OF NEW WORK.

	Wards.	Calls for Non-payment.	Shut for Non-payment.	Examined New Connections.	Examined Exten's and Fixtures.	Let on New Connections.	Notified for Building Tax.	Shut for Vacancy.
ichael Hart	8, 10 and 12	1,950	496	403	391	300	20	30
ohn Hatzenbuhler	7, 9 and 11	2,019	152	376	390	237	25	20
ohn Becker	2, 4 and 6	2,145	239	326	250	248	78	90
dolph Jasnowski	14 and 16	1,903	209	472	325	169	33	19
. J. Skinner	1, 3 and 5	2,423	109	265	340	307	114	187
obert Pelham, Jr	13 and 15	2,024	220	573	310	308	38	72
Total		12,464	1,425	2,415	2,006	1,569	308	418

In addition to the above work, the inspectors have devoted onsiderable time in examining and locating stop boxes, and rdering them exposed to sight, repaired or replaced with new nes as the case required. It necessitates the utmost vigilance to keep the stop-boxes exposed to view. Sidewalks being repaired, new ones built, or change of grade in street, alley or lot, the tendency is to pay little attention to the stop-box, and it is usually covered up, as the majority of water takers can see very little use for it until there is an urgent request for shutting off the water in case of bursted pipes, etc., when they have a forcible reminder of its necessity. Not only that, but during the last year there have been 12,464 places reported to be shut off for non-payment, besides many places for vacancy, showing the need of keeping the stop-boxes in sight at all times. A duty that will always exist will be that of seeing they are kept in proper condition, and as there are thousands of them, and increasing daily, one can readily see that it will require much time and watchfulness on the part of the inspectors in giving them the necessary attention.

The following table shows the total number of taps, with iron and wood pipes, of sizes from ⅝ to 6 inches.

NUMBER OF SERVICE CONNECTIONS.

Size of Connection.	No. in 1892.	Added in 1893.	Discontinued 1893.	Total January 1, 1894.
Cast iron, 6-inch diameter	3	....	....	3
" " 4 " "	63	10	....	73
" " 3 " "	98	9	....	107
" " 2 " "	102	18	....	120
" " 1 " "	9,394	841	14	10,221
" " ⅝ " "	33,549	1,519	40	35,028
Wood pipe	3,409	8	312	3,105
Aggregate	46,618	2,405	366	48,65[illegible]

	WARDS.																TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
New connections, iron pipes, ⅝ inch	30	9	35	40	44	42	47	55	140	71	112	67	140	126	325	236	1,519
New connections, iron pipes, 1 inch	77	105	39	47	27	67	5	43	34	98	25	60	32	53	74	55	841
New connections, iron pipes, 2 inches	3	5	...	3	...	4	...	...	...	1	...	1	...	...	1	...	18
New connections, iron pipes, 3 inches	2	1	1	...	...	...	1	2	...	...	...	...	..	2	...	...	9
New connections, iron pipes, 4 inches	3	1	...	1	...	1	2	...	...	1	...	1	...	..	...	..	10
New connections, wood pipes, ⅝ inch	...	..	3	...	...	...	...	1	...	...	...	...	1	...	...	...	5
New connections, wood pipes, 1 inch	...	...	1	...	...	...	...	2	...	...	...	...	...	...	..	...	3
TOTALS	115	121	79	91	71	114	55	103	174	171	137	129	173	181	400	291	2,405
Discontinued wood connections, ⅝ inch	...	...	...	...	...	...	...	130	42	42	67	23	...	...	...	...	304
Discontinued wood connections, 1 inch	...	...	...	...	...	...	...	1	2	2	...	3	...	...	...	...	8
Discontinued iron connections, ⅝ inch	3	3	6	5	3	3	4	5	1	2	...	4	...	1	...	...	40
Discontinued iron connections, 1 inch	4	3	3	4	...	...	...	...	...	...	...	...	...	...	...	...	14
TOTALS	7	6	9	9	3	3	4	136	45	46	67	30	...	1	...	...	366

Attached to this report are complete lists of tools on hand and an itemized account of material in stock in the Meter and Service Cocks Departments, on the 31st day of December, 1893.

In concluding this report, will say that I have endeavored to conduct the work in the departments over which I have charge, with as much economy as possible, and the employés under my supervision have shown a faithfulness in their work that leads me to believe that the Water Works has received full value for the money expended during the past year.

The uniform kindness shown me and the able assistance given by the Secretary, is appreciated to the fullest extent, and for the kind and considerate treatment of your honorable body throughout the past, I beg to offer my warmest thanks.

All of which is respectfully submitted.

T. R. PUTNAM,
Superintendent Meters and Inspection.

REPORT OF CHIEF ENGINEER AT PUMPING WORKS.

DETROIT, January 1, 1894.

e ***Board of Water Commissioners:***

NTLEMEN—I have the honor to submit the Engineer's **rt** for the year 1893.

ne following table shows the number of gallons of water ped, and cost of fuel for the years named:

YEAR.	GALLONS OF WATER PUMPED.	COST OF FUEL CONSUMED.	AVERAGE DAILY DELIVERED.
	235,840,271	....	646,411
	308,531,748	$2,129 37	981,594
	376,265,126	2,271 34	1,030,866
	542,807,364	3,325 81	1,487,148
	692,124,305	4,017 44	1,896,231
	697,190,523	3,9[illegible]3 20	1,909,837
	718,091,277	3,655 20	1,967,373
	782,112,587	3,194 15	2,142,774
	870,036,451	4,196 21	2,383,580
	895,129,423	4,414 07	2,452,409
	994,945,829	3,150 95	2,725,878
	1,035,798,048	4,670 86	2,837,808
	1,018,390,256	7,647 62	2,839,078
	1,049,514,887	7,372 89	2,875,383
	1,196,317,922	9,349 16	3,277,583
	1,425,535,280	10,121 82	3,905,576
	1,666,545,125	11,379 23	4,507,248
	1,946,810,325	11,247 92	4,511,809
	1,866,060,068	12,713 78	5,112,493
	2,300,150,605	14,681 05	6,301,782
	2,782,292,578	17,736 86	7,601,892
	3,198,393,948	20,233 30	8,762,723
	3,289,872,635	20,4[illegible]1 71	9,013,350
	4,207,454,260	21,393 98	11,527,272
	4,065,134,170	19,832 89	11,107,499
	4,213,239,790	17,433 72	11,543,123
	4,345,743,330	10,943 82	11,906,146
	5,129,599,110	11,219 51	14,053,696
	5,552,965,310	12,276 60	15,172,036
	6,543,127,968	16,556 63	17,926,377
	6,281,000,742	13,156 16	17,261,440
	7,379,327,188	16,495 99	20,217,334
	8,510,614,140	19,877 07	23,253,044
	9,970,8[illegible]9,580	21,341 48	27,317,341
	10,576,571,254	20,387 24	28,976,907
	13,168,859,868	35,852 83	36,079,166
	14,380,166,670	32,568 66	39,397,716
	12,875,334,153	34,413 31	35,274,888
	12,120,944,532	31,852 40	33,209,067
	12,057,261,236	33,826 86	33,033,592
	12,476,612,482	31,031 40	34,182,499
	13,877,977,208	27,479 93	38,021,855

The following tables show in detail the work done by each engine each month of the year.

ENGINE No. 1.

MONTHS.	Time run.		Revolutions.	Gallons.	Gallons of Oil.	Cost of Oil		Duty.
	H.	M.						
January	696	....	380,801	502,016,400	63,620	$954	30	76,311,768
February	672	....	358,190	554,478,120	65,487	1,050	93	81,206,986
March	576	....	290,355	449,469,540	54,263	873	63	78,755,194
April	....	...	....	....	....	....		....
May	252	40	110,149	170,510,652	21,155	340	60	76,631,868
June	405	40	195,807	303,109,236	37,513	604	44	78,134,672
July	385	40	251,852	389,866,896	49,300	793	73	76,505,442
August	72	40	47,294	73,211,112	9,130	142	42	77,576,514
September	427	45	211,233	326,988,684	39,630	618	22	79,823,853
October	596	45	304,233	470,952,684	62,530	975	46	72,863,979
November	302	05	147,859	228,885,732	30,514	476	01	71,942,159
December	......	..	....	....	....	....		....
Total	4,387	15	2,297,773	3,469,489,056	433,172	$6,829	73	....

ENGINE No. 2.

January	456	....	269,763	407,203,488	51,600	$774	00	76,311,775
February	672	....	405,270	651,674,160	76,866	1,235	08	81,207,245
March	624	....	356,131	491,216,664	59,329	955	20	78,718,537
April	426	35	306,885	246,735,540	30,112	484	80	77,904,583
May	581	45	351,966	483,789,356	53,822	866	53	76,6·7,288
June	465	05	261,771	420,927,768	52,130	839	29	78,114,783
July	100	35	59,668	95,946,144	12,132	195	32	76,510,690
August	483	15	283,138	455,285,904	56,782	885	79	77,570,672
September	481	40	262,751	422,503,608	51,205	798	79	79,825,588
October	744	....	386,130	620,897,040	82,440	1,286	47	72,862,764
November	534	....	291,688	354,622,892	47,276	737	40	71,948,230
December	732	45	419,147	336,994,188	45,534	710	33	70,865,188
Total	6,301	40	3,654,308	4,987,796,752	619,328	$9,769	00	....

ENGINE No. 3.

January	336	....	206,900	372,420,000	47,220	$708	30	76,291,289
February	......	....	....	....	....	....		....
March	288	....	151,441	272,593,800	32,913	529	90	78,744,229
April	720	....	410,225	738,405,000	90,115	1,450	85	77,905,558
May	432	....	249,970	449,946,000	55,823	898	75	76,633,405
June	408	....	241,660	434,988,000	53,880	867	46	78,104,081
July	744	....	422,560	760,608,000	96,182	1,526	18	76,505,230
August	744	....	424,046	763,282,800	95,190	1,484	96	77,574,462
September	504	....	284,195	511,551,000	61,983	966	93	79,843,650
October	......	....	....	....	....	....		....
November	433	....	232,262	418,071,600	55,734	869	47	71,943,781
December	744	....	416,014	748,825,200	101,180	1,578	40	70,364,997
Total	5,353	....	3,039,273	5,470,691,400	690,220	$10,881	20	....
Aggregate	16,041	55	8,991,354	13,877,977,208	1,742,720	$27,479	93	....

Fuel oil consumed	$27,479	93
Salaries, engineers and firemen	16,571	59
Consulting engineer	1,200	00
Coal for pumping oil	72	05
Printing and stationery	24	15
Material: rags, waste, polish, etc	288	18
" valves, gaskets, grate bars, etc	280	99
Repairs, boilers and machinery	135	71
Lubricants	251	43
Tools and repairs	115	45
Medical attendance (injury by accident in 1892)	20	50
Ice	20	80
Horse, harness and repairs	57	55
Horse-feed, shoeing, etc	62	50
Street-car tickets	10	00
Expense on electric-light plant	55	18
	$46,546	01

Cost per million gallons, $3.35. Engines No. 1 and 2 were run part of the year with one pump detached.

The tables show that the water pumped during the year is 13,877,977,208 gallons. The total expense for pumping water is $46,546.01, making cost per million gallons, $3.35. Our average pressure during the year has been higher than ever before, and the cry of short supply is very seldom heard.

The engines and boilers have had only minor repairs during the year, but the boilers will need some repairs soon: otherwise we are now in fair condition.

It is often necessary to reduce the capacity of the three engines now in operation, at such seasons of the year when the demand is at the minimum. This can only be done by stopping the engines, pumping out the well and disconnecting one of the pumps, at a loss of considerable time and expense, besides leaving the engine in a crippled condition. As a matter of safety and economy, I would recommend putting in a connection between the pumps, with valves so arranged that the engines could be changed from one-half to full capacity without stopping.

We have had nearly two years' experience with crude oil for fuel. It is very convenient, and also economical, as the following facts show: Our daily average for 1893 is 38,021,855 gallons, which nearly equals the daily average for 1888, when the cost for coal was $39,568.66, whereas this year the cost for oil is $27,479.93, making a saving of $12,088.73, which we think is remarkable, considering the fact that we have pumped against a pressure of 125 feet during the warm days of summer, whereas we formerly pumped against only 116 feet. We expect to make a still further reduction the coming year, when our new triple expansion engine is ready for use, which we expect will be the latter part of January. This will add twenty-four million gallons to our maximum daily capacity, which will then be one hundred and two millions.

This engine is considered the most economical pumping engine made, and may be described as follows: Vertical triple expansion high steam cylinder 28 in., intermediate 48 in., 74 in. in diameter, with a stroke of sixty inches. The steam cylinders are steam jacketed and covered with non-conducting material, with black walnut in narrow strips fastened on with nickle-plated bands and screws. The cylinders are fitted with the Reynolds-Corliss valve gear, especially arranged for this type of engine, having independent adjustable cut-offs for each cylinder. There are three pumps located beneath and directly in line with the cylinders. The pump plungers are rigidly connected to the steam piston by means of four steel distance rods, passing directly from the cross-heads to the pump plungers. The pumps are of the single-acting, outside-packed plunger type, each pump having one plunger 36 in. in diameter, 60-in. stroke. The suction pipe is 48 in. and discharge 42 in. in diameter. The condenser is of the jet type. The main shaft 18 in. diameter, journal 16 in. and 24 in. long. There are three cranks, set at angles of 120 degrees apart; two fly wheels, 20 feet in diameter, weighing 25 tons each. Steam will be supplied by four horizontal tubular boilers, 62 in. diameter, 20 feet long, each boiler containing forty-nine 4-in. tubes. The boilers are constructed of the best flange steel, 60,000 pounds tensile strength, thoroughly braced and stayed to carry a working pressure of 125 pounds per square inch. The boiler fronts are of cast iron. The engine is nearly completed, and I am satisfied will prove a great saving in fuel, and also give us the benefit of higher pressure when needed.

It is very frequently necessary to raise the pressure higher than our stand-pipe, and, as the stand-pipe does not relieve the engines, I would recommend connecting the 30-inch main thereto, through a weighted relief valve, direct to the waste, and discontinue the use of the stand-pipe altogether.

The buildings have recently been painted and striped, greatly improving their appearance. Removing the old wooden shed and using part of our coal shed for a blacksmith shop, horse stable and store room, is a decided improvement.

For fire protection and washing out wells, I would recommend extending the 4-inch water-pipe to the south end of the shed and setting a fire hydrant.

You will notice the duty has fallen off during the cold weather, which may be accounted for by the additional space heated by steam.

Inlet pipe number two has been out of use for some time, being reported in a leaky condition by submarine diver Dwyer. As it is necessary to use three inlets at times, I would recommend having this pipe relaid the coming season.

Respectfully submitted.

URIAH GOULD,
Engineer.

REPORT OF THE SUPERINTENDENT OF GROUNDS.

To the Honorable the Board of Water Commissioners:

GENTLEMEN—In submitting my report for the year 1893, I wish to say, first, that the Park is rapidly growing in popularity. Visitors, the past season, far outnumber those of former years, and many expressed themselves as delighted with the arrangement of flower beds and the general care of the Park. The greenhouse built in the fall of 1892 has been of great value, enabling us to make a floral display equal to any in the city. When the different improvements begun this season are completed, which we hope will not be later than June 15th, the Hurlbut Park will be one of the most attractive in the city.

The Hurlbut Memorial Gate, with a frontage of one hundred and thirty-two feet, and fifty feet high, is certainly one of the finest structures of stone and iron to be found in this country.

The iron fence along the front, extending back one hundred feet on the east and west lines, adds very much to the appearance of the grounds.

The waterway, or canal, now being cut from the river through what has been heretofore low marsh, so as to leave two small islands, practically reclaims this whole section of the grounds, and, instead of rank growth of flags and stagnant water, we will have a beautiful winding canal, where row-boats may come well up into the Park. When this part of the grounds is properly graded and trees, shrubs and flowers planted, it will be one of the pleasantest parts of the Park.

Removing the unsightly old coal tramway and dock, and sloping the canal bank to the water's edge, changes very much the appearance of this part of the grounds. What has heretofore been a storage place for old pipes, lumber, iron, etc., will be beautiful lawn, walks, trees, shrubs and flowers.

The new addition to our greenhouse will double the former capacity, and give us an opportunity to increase our floral display in keeping with other improvements.

There is now needed a suitable toilet room for ladies, and also a shelter for horses and carriages. Part of the space between the coal sheds could be covered with corrugated iron roof, supported on iron posts, and would make such shelter with very little expense.

The inventory of tools and implements in this department accompany this report.

Very respectfully,

E. A. SCRIBNER,
Superintendent of Grounds.

REPORT OF THE SUPERINTENDENT OF EXTENSIONS.

DETROIT, January 2d, 1894.

To the Board of Water Commissioners:

GENTLEMEN—In accordance with the regulations of your Honorable Body, I have the honor of presenting my annual report, relative to the general condition and progress of the work in this department.

During the year just closed, not less than thirty-two miles of extensions have been made to our pipeage.

It had been, I believe, the desire of your Honorable Body, to make the general expenses of the Works for the year just closed, as light as possible. It would, however, seem from the above mentioned mileage laid, that so far as this department was concerned, it had failed.

It is somewhat difficult to approximate very closely the probable outlay of this branch of the work at the commencement of the year, it being largely governed by the number of calls during the year for extensions.

The calls for extensions for the past season have been more numerous than the times would seem to demand. Should the coming season be one of increased activity, I anticipate no very great abatement to this branch of the work, and from the large amount of unoccupied land in the recently annexed territory, we may expect to receive numerous calls for extensions. The work in this department has compassed nearly 500 points or lines of extensions, the chief of which have been the extension of the Abbott street line of 24-inch main; this was extended on Tenth street to Michigan avenue, and from this point to Vinewood avenue, connecting with the 24-inch main in said avenue. The 16-inch main in Park street was also extended in said street to Columbia street, and in this street westward to Cass, thence north on Cass to Gilman street, and on Gilman and Cherry streets to Seventh street; from this line a 12-inch main was laid in Sixth street to Bagg street, connecting with the 24-inch in Bagg street.

A line of 10-inch main was laid in the more easterly portion of the city, this line was laid in Meldrum avenue, connecting with the 42-inch main in Jefferson avenue, thence running south to Wight street, and from this point westward to McDougall avenue, thence south to Guoin street, and in this street westward again to Orleans street, connecting with the 10-inch main at this point.

In addition to the foregoing, a few of the lines recommended in last year's annual report by the Fire Department and myself, have in part been complied with. These are as follows: A 10-inch main in State street from the 30-inch in Washington avenue and State street to Cass street, connecting with the 10-inch in Cass street. An 8-inch main in Monroe avenue from Randolph to St. Antoine streets, connecting with all the lines crossing the same. Also an 8-inch main in Elizabeth street, from Cass to Grand River avenues, connecting with the Cass and Grand River avenue mains. A short section of 8-inch was also laid in Forest avenue, from Trumbull to Avery avenues. An 8-inch main was laid in Wabash avenue from the 30-inch in Buchanan street to Lake Shore R. R. A short section of 10-inch was laid in Hamilton Boulevard, from Hazlewood to Bancroft avenues. A section of the proposed 10-inch in St. Aubin avenue was also laid from the 24-inch main in the N. Boulevard to Trombly avenue, and from which a line of 8-inch pipe was laid in Trombly avenue to Russell street. A short section of 8-inch pipe was laid in Oakland avenue from Englewood avenue north to the city limits. A few lines of 6-inch pipe were laid in the following places: Hastings street from the N. Boulevard to Trombly avenue; Piquette avenue from Beaubien to Russell streets; and Adair street from Jefferson avenue to south of Wight street.

In addition to the above, quite a number of special lines of 6-inch were laid.

RECOMMENDATIONS.

I would respectfully recommend that the following lines may be laid for a more general supply and for better fire protection.

Appended are a few locations which I believe are worthy of your prayerful consideration, and which have been greatly overlooked in the anxiety to care for the more business portions of the city. The following are a few of this order :

Second street; from Fort to alley south of Abbott street, distance 900 feet.

Third street; from Fort to Abbott streets, distance about 1,030 feet.

Fifth street; from alley south of Howard to Labrosse streets, distance about 1,125 feet.

Sixth street; from Abbott to alley north of Labrosse street, distance about 825 feet.

Eighth street; from Fort to Baker streets, distance about 2,025 feet.

Trumbull avenue; from Fort to alley south of Abbott street and from Abbott street to Michigan avenue, distance about 2,500 feet.

There are now no water mains within the above-mentioned distances, the supply of water is through the alleys, most of which are 4 inches in diameter. Each of the above-mentioned lines would have a direct connection with the 24-inch main in Abbott street, and a few with the 16-inch main in Fort street.

I again mention the following lines, which appeared in last annual report of recommendations:

Twelfth street, from Howard to Baker streets. This street is densely built up with residence property, and at Howard street are several large manufactories. A larger main should be laid than the one now in use; the present one is only 4 inches. It would greatly improve this section if a line of pipe should be extended along Abbott street from the 24-inch main at Abbott and Tenth streets to Twelfth.

I am still of the opinion that the laying of a 12-inch pipe in Commonwealth avenue from the 30-inch main in Brigham treet to Kirby avenue, is a wise thing to do, as recommended year ago, and from which the laying of an 8- or 10-inch in Kirby avenue from Grand River to Woodward avenues. This rrangement would make a splendid cross-feed to the interecting lines, and should it be needed to lay for better fire proection in the immediate streets crossing Commonwealth venue, this would be an excellent feeder in this locality. The ine in Commonwealth avenue is about 3,200 feet, and the one n Kirby avenue would be about 8,500 feet. A similar line to his would be well to consider for the east side, extending to nd connecting with the 30-inch main in Collins street.

I would again mention Park street. There is but a 4-inch ipe in this street from Henry to Peterboro, and also in the ntervening streets crossing Park street; this street is densely uilt up and should have better fire protection. This line would ave a direct connection with the 24-inch in Bagg street and he 16-inch main at Park and Columbia streets.

John R. street, from Piquette avenue to N. Boulevard. This would connect direct with the 24-inch main in said Boulevard nd would cross the tracks of the L. S. & M. S., D. & B. C., G. T. and Belt Line R. R's, insuring an ample supply of water for this very desirable business centre, as well as for efficient fire protection.

There are a number of others which might be added to the above, which were mentioned in the last annual report.

Toledo avenue, from Hubbard avenue to Twenty-fourth street, distance about 1,575 feet. By the laying of this line we should get a direct connection with the 24-inch in Vinewood avenue, and would give a better circulation, curing one or more dead ends, and furnish a better supply for fire protection.

Sullivan avenue, from the N. Boulevard to Baltimore avenue, distance about 750 feet. This would also give a direct supply from the 24-inch main in the said Boulevard, thereby adding greatly to the supply for fire protection and curing dead end at Milwaukee avenue.

Appended is a tabulated statement of the pipeage now in use classified by its diameters and lengths.

PIPEAGE.

The amount of distribution pipe and mains laid and relaid, and iron and wood pipe discontinued during the past season, is as follows: Total iron pipe laid and relaid, $32\frac{478}{5280}$ miles, of which 687 feet were relaid and 1368 feet were laid for private use. $1\frac{2850}{5280}$ miles of wood and $6\frac{2446}{5280}$ miles of iron pipe were discontinued, making the net increase of the pipeage $24\frac{1975}{5280}$ miles. This amount added to the measured lines of iron and wood pipe connected with the works, will make the total length $455\frac{4794}{5280}$ miles, of which $452\frac{1485}{5280}$ miles are iron and $3\frac{3309}{5280}$ miles are wood pipe.

Which in detail is as follows:

Size of Pipe in Inches.	Measured Length in Feet for 1892.	Added Length in Feet for 1893.	Discontinued Length in Feet for 1893.	Total Length in Feet for 1893.
45	103	....	....	103
42	44,909	218	....	45,127
36	715	....	....	715
30	49,337	....	... .	49,337
24	75,174	9,687	48	84,813
20	461	....	....	461
18	87	....	....	87
16	32,319	4,500	42	36,777
12	6,598	1,880	34	8,444
10	104,259	10,346	96	114,509
8	218,095	8,759	7,059	219,795
6	805,571	115,636	3,799	917,408
4	832,406	16,357	17,415	831,348
3	78,367	1,368	3,433	76,302
2	2,820	....	....	2,820
Total,	2,251,221	168,751	31,926	2,388,046

WARD.	4-In.	6-In.	8-In.	10-In.	12-In.	16-In.	18-In.	20-In.	24-In.	30-In.	36-In.	42-In.	45-In.	2-In.	3-In.	Logs.	Lead	Totals.	Feet Discontinued	Feet Added
First	73,248	50,283	13,161	26,882	1,280	13,841	......	......	6,754	3,934	......	2,349	......	......	5,899	1,165	......	198,796	41	6,092
Second	50,079	43,276	6,142	16,281	412	7,556	......	......	5,913	4,184	......	......	......	......	3,064	......	......	136,907	5,447	9,487
Third	41,173	33,980	6,158	6,712	......	2,124	......	......	4,548	2,399	......	1,679	......	......	6,146	3,849	......	108,768	1,412	6,816
Fourth	66,428	46,855	6,233	976	......	3,556	......	......	5,323	3,253	......	......	......	......	6,412	1,404	......	140,440	1,302	11,516
Fifth	58,669	20,368	8,796	9,720	715	1,032	......	......	3,678	2,513	......	1,749	......	......	4,283	5,193	......	116,716	64	4,526
Sixth	52,823	32,134	13,413	3,871	1,650	1,565	......	......	5,483	2,533	......	......	......	......	5,382	165	......	119,019	2,450	4,944
Seventh	48,180	20,114	18,093	3,576	2,514	745	......	406	11,255	3,083	......	1,829	......	......	2,583	736	......	113,114	2,064	5,482
Eighth	51,264	48,609	18,205	161	42	......	......	......	8,277	2,153	......	......	......	......	8,180	......	175	137,066	3,928	12,421
Ninth	62,082	63,730	11,449	4,103	1,815	......	......	......	2,433	12,063	715	3,369	......	......	7,600	2,630	......	171,989	1,365	9,695
Tenth	81,658	79,570	18,612	6,971	......	......	......	......	10,967	2,443	......	......	......	......	4,246	......	......	204,467	3,032	14,776
Eleventh	56,414	51,033	5,149	3,626	......	......	......	......	1,463	......	......	3,479	......	......	6,776	4,938	16	132,894	1,753	6,406
Twelfth	29,145	67,268	16,996	3,951	16	140	87	55	7,003	2,593	......	......	......	......	3,204	......	......	130,458	1,811	8,714
Thirteenth	61,293	43,759	8,002	2,992	......	......	......	......	513	7,173	......	7,519	......	......	7,556	41	......	138,848	5,983	14,878
Fourteenth	32,900	85,461	17,695	5,241	......	2,685	......	......	11,203	1,013	......	......	......	......	3,119	......	160	159,477	24	13,900
Fifteenth	38,591	128,441	32,349	8,674	......	......	......	......	......	......	......	23,154	103	2,820	134	......	143	234,409	1,250	17,110
Sixteenth	23,916	89,227	18,317	10,772	......	3,533	......	......	......	......	......	......	......	......	1,718	......	......	147,483	......	13,584
Outside City Line	3,485	13,300	1,025	......	......	......	......	......	......	......	......	......	......	......	......	......	......	17,810	......	8,404
Totals in Feet.	831,348	917,408	219,795	114,509	8,444	36,777	87	461	84,813	49,337	715	45,127	103	2,820	76,302	20,121	494	2,408,661	31,926	168,751

It is very gratifying to know that the log or wood pipe system is rapidly disappearing. From the table of pipeage we see recorded but a little over three miles now in use; and yet this system of logs laid for the conveyance of water has greatly added to the growth of the city and comfort of its citizens, and from the fact of its slight cost, as compared with the cost of iron pipe of that early day, the out-lying streets and the greatly scattered dwellings could not be reached without a burdensome expense to the water takers.

Our 3-inch iron pipe is also diminishing in length from year to year, giving place to pipe of larger size, and whatever of this size may appear in our reports as being laid, it should be remembered that it is not laid in any public street or alley, but is laid for some minor purpose.

The adoption of this size pipe in the early past was to take the place of the logs, this being the most economic size for the times; and while some of the lines of this size may at this late day seem very small for the streets in which it is laid, these streets were but little built upon, and might well be called suburban localities. The policy of the Board at that time was, that as the city developed in size and wealth it would be better able to lay large mains.

During the past year, 536 water gates have been set and 85 reset; 559 were for street shut-offs and 62 for blow-offs; 55 were taken out. These were taken out either for repairs or to be replaced with larger gates, on lines replacing smaller pipe. The following is a tabulated statement of the kind, size and number of the herein mentioned gates:

TABLE OF NEW GATES SET FOR SHUT-OFFS.

NAME OF GATE.	SIZE.	REMARKS.
Murdock Valve Company	42-in.	Set for Shut-offs.
" " "	12-in.	" "
" " "	10-in.	" "
" " "	8-in.	" "
" " "	6-in.	" "
" " "	4-in.	" "
" " "	3-in.	" "
Michigan Brass and Iron Works	20-in.	" "
" " "	16-in.	" "
" " "	12-in.	" "
" " "	10-in.	" "
" " "	8-in.	" "
" " "	6-in	" "
" " "	6-in.	For Blow-offs.
" " "	4-in.	" "
" " "	4-in.	For Shut offs.
Total.		

BLE OF OLD GATES RESET FOR SHUT AND BLOW-OFFS.

NAME OF GATE.	SIZE.	REMARKS.
Flower Bros	42-in.	Reset Shut-off.
Eddy	24-in.	" "
Murdock Valve Company	8-in.	" "
" " "	4-in.	" "
" " "	4-in.	Set for Blow-off.
Galvin Bros	4-in.	Reset Shut-off.
Flower Bros	4-in.	" "
" "	4-in.	Set for Blow-off.
Pittsburgh	4-in.	" "
Ludlow	6-in.	" "
"	4-in.	" "
Total.		

TABLE OF GATES TAKEN OUT.

No. of each kind.	NAME OF GATE.	SIZE.
8	Flower Bros	8-in.
8	Flower Bros	4-in.
1	Flower Bros	3-in.
1	Eddy	8-in.
1	Eddy	6-in.
4	Murdock Valve Company	6-in.
15	Murdock Valve Company	4-in.
5	Pittsburgh	4-in.
4	Galvin Bros	4-in.
5	Ludlow	4-in.
3	Michigan Brass and Iron Works	4-in.
55		

There are now 4,867 stop gates in use in the mains and distribution pipes, ranging in sizes from 3 to 42 inches, and, in addition to this number, we have 667 blow-off gates; these are not all located at dead ends, many of which are permanent, set at special points along the lines of pipes.

The appended table gives the length of 3, 4, 6, 8, 12 and 16-inch pipe, and logs which have been replaced with pipe of larger size, in detail, as follows:

SIZE OF PIPE LAID.	SIZE OF PIPE AND LOGS REPLACED.	LENGTH OF PIPE LAID.
-inch iron pipe.........	3-inch iron pipe.........	24 feet.
6 " " "	3 " " "	3,084 "
6 " " "	4 " " "	5,907 "
6 " " "	Log pipe............ ...	5,723 "
8 " " "	" "	2,407 "
8 " " "	4-inch iron pipe.........	2,640 "
8 " " "	6 " " "	125 "
0 " " "	3 " " "	325 "
0 " " "	4 " " "	2,718 "
0 " " "	6 " " "	2,624 "
2 " " "	4 " " "	1,650 "
6 " " "	4 " " "	4,500 "
6 " " "	8 " " "	38 "
6 " " "	12 " " "	34 "
6 " " "	16 " " "	42 "
4 " " "	6 " " "	1,050 "
4 " " "	8 " " "	7,021 "
TOTAL..............	....	39,912 "

There were connected with the water mains 46 hydrants nd 15 reservoirs, making the total number now in use 2,338 ydrants and 494 reservoirs.

We have this year done considerable horizontal boring nder our asphalt, brick and wood pavements, having a ement concrete foundation, and also under the earth embankments of the railroad tracks. A machine for this purpose was onstructed, whereby we have accomplished this work very uccessfully. The machine is driven by steam power, a small ortable engine and boiler doing the work.

The use of this machine has saved much annoyance to the raffic on our busy street crossings, also at the railroad crossng, as would otherwise be had were we to make an open rench as formerly, for our pipe-laying at such points. We ave bored for pipe from 6 to 16 inches, the hole being of ufficient size to allow the hub of the pipe to pass freely hrough the hole, the barrel of the pipe being lagged out to he size of the hub with pine scantling of proper size.

There are quite a number of pipe lines crossing the Chene street 30-inch main that are not as yet connected with the same which it would be well to connect, and a few on the easterly end of the upper 42-inch main in Mack avenue. Quite a number of streets have been opened along these lines since the mains were laid.

REPAIR DEPARTMENT.

This department of the Works has received its usual and efficient attention to the many items of work coming under its care. The foreman and men are deserving of much credit for their efficient services.

I am glad to say that, while there have been quite a few breaks in our pipeage during the past season, only two have occurred in the larger mains. These were promptly met; no serious damage resulting from either of them, other than the bursting of the pipe. The one in the 24-inch main, East Congress street, was found split near its lower side about 4 feet of its length. The defective piece was cut out and a new piece inserted and sleeved up. The one in Vinewood avenue was found ruptured concentric with the axis of the pipe, the ground having settled at this point from the building of a main sewer, which caused the rupture. We were enabled to make repairs without having to shut off the flow of water in the mains—a few pine wedges were driven in the opening and a bolted sleeve leaded in and calked on.

PUMPING WORKS.

Force Mains.—The alterations in the 42-inch mains mentioned in the last annual report, have been made; the arrangement being such that either of the engines can be run in conjunction with or independent of each other, and can be used jointly with either of the two mains, or, with the proposed third main when the same shall be laid.

There is still an apparent need of a further change in the main leading out from No. 3 engine; this would be for a more direct flow through the lower main.

The new engine has been connected with the outlaying rce mains. A 42-inch back pressure check valve was set in nnection with the said engine and mains.

Conduit.—The building of the brick conduit for the conyance of water to the above-mentioned engine, was comleted early the past season, with all its appendages. The uth end, connecting with the west gate and strainer well, d the north end with the suction pipe leading out from said gine, four 48-inch cast-iron curved pipe were required in aking the connection.

In closing this report it is only courteous to say that the elp in the office of this department has been very efficient. ransmitted with this report are the locations of the pipes and ains, also gates, to January 2, 1894.

Respectfully submitted,

HENRY BRIDGE,
Superintendent of Extensions.

CHANGES IN STREET NAMES, SO FAR AS ASCERTAINED, AND THEIR APPROXIMATE LOCATION.

PRESENT NAME.	FORMER NAME.	
Avery ave	Morley st	N. from Lothrop.
Bancroft ave	Williams ave. and Joy road	W. from Woodward.
Barker ave	Ferry ave	E. from McClellan.
Barry st	Willis ave	E. from McClellan.
Beaman st	Sherman st	W. from Crane.
Belvidere ave	Company and Bolde aves	E. of McClellan.
Bingham st	Forest ave	E. from Cadillac.
Blair st	Palmer ave	E. from McClellan.
Bradley st	Mullett st	W. from Crane.
Brock st	Lincoln ave. and Seventh st	N. from Lothrop.
Bruce st	Champlain st	W. from Crane.
Buhl st	Canfield ave	E. from Holcomb.
Burlingame ave	Englewood ave	W. from Woodward.
Calumet ave	Brigham st	W. from Third ave.
Canton ave	Godfrey ave	N. from Centerline rd.
Carleton st	Forest ave	E. from McClellan.
Carver st	Commonwealth ave	N. from Lothrop.
Chapin st	Hendrie and Medbury	E. from Fischer ave.
Clay ave	Pallister ave	E. from Woodward.
Conger st	Piquette ave	E. from Baldwin.
Cook st	Poplar st	E. from Welch ave.
Crane ave	Laclede ave	N. from Mack.
Crary st	Clinton ave	W. from Crane.
Cresswell st	Kirby ave	E. from McClellan.
Dallas st	Morton st	E. from Riopelle.
Deming st	Gilbert st	E. from Scotten.
Dillon ave	Lincoln ave	N. from Holden.
Douglas st	Warren ave	E. from McClellan.
Duncan st	Milwaukee ave	E. from Helen.
Durand st	Maple st	E. &W. from VanDyke.
Eldred st	Chandler st	W. from Junction.
Emmons st	Julia H st	E. from McClellan.
Erskine st	Calhoun st	W. from Gratiot.
Fairbanks st	Lafayette place	E. from Scotten.
Felch st	Piquette ave	E. from McClellan.
Ferry ave	Kirby ave	E. from Baldwin.
Finley st	Custer ave	W. from Jos. Campau.
Fischer ave	Jayne and Richard aves	N. from Mack.
Forest ave	Garfield ave	E. from McClellan.
Foster st	Beaufait ave	N. from Centerline rd.
Gillett st	Blain and Chandler	W. from St. Aubin.
Goodwin st	Hastings st	N. from Holbrook.
Gordon st	Warren ave	E. from Cadillac.
Goethe st	Elm Grove ave	W. from McClellan.
Granger st	Palmer ave	E. from Baldwin.
Graves st	Hancock ave	E. from Holcomb.
Greeley st	Riopelle st	N. from Reutter.
Greenwood ave	Crawford st	S. from Boulevard.
Grummond ave	Cleveland ave	W. from Woodward.
Haigh ave	Bigelow and Andrus	W. from St. Aubin.
Hamilton Boulevard	Crawford st	N. from Boulevard.
Harper ave	Centerline road and Butler ave	N. City line.
Hecla ave	Harrison ave	N. from Merrick ave.
Hendrie ave	Boulevard	E. from Baldwin.
Holcomb ave	Ackley ave	N. from Gratiot.
Homer st	Agnes ave	W. from Crane.
Houghton st.	Charles J	E. from Holcomb.

NAME.	FORMER NAME.	
	Harper and Trombley aves	E. from Helen.
st.	Baltimore ave	E. from Baldwin.
	Farnsworth st	E. from Baldwin.
st.	Riopelle st	N. from Pallister.
ave.	Parker ave	W. from Concord.
t.	Trombley ave	E. from Baldwin.
ave.	Volunteer ave	W. from McKinstry.
st.	Laferty place	Howard to M. C. R. R.
st.	Piquette and Kanter aves	E. from Concord.
	Croghan st	W. from Crane.
st.	Farnsworth st	E. from McClellan.
ave.	Green ave	N. from Holden.
r st.	Harper ave	E. from Helen.
st	Orleans st	N. from Pallister.
	Bellair st	W. from Gratiot.
ave.	Lincoln ave	W. from St. Aubin.
st.	Macomb st	W. from Helen.
ave.	Morton ave	N. from Gratiot.
t.	Seventh st	N. from Lothrop.
	Trombley ave	E. from Helen.
t.	Frederick st	E. from Holcomb.
t.	Avery ave	N. from Lothrop.
st	Dequindre st	N. from Pallister.
st.	Theodore st	E. from McClellan.
t.	Canfield ave	E. from Van Dyke.
ave.	Jerome ave	N. from Piquette.
	Whitaker ave	E. from Russell.
ave.	Ferry ave	E. from Baldwin.
ve	Belle Isle ave	E. of Van Dyke.
ave.	Irving and Fourth aves	W. from Woodward.
t	Harper ave	E. from Baldwin.
phia ave	Moeller st	E. from Russell.
t.	Horton ave	W. from Jos. Campau.
st.	Canfield ave	E. from Cadillac.
t.	Prospect ave	N. from Pallister.
re.	Crane ave	N. from Mack.
ave.	Fifth ave	W. from Woodward.
ave.	Morross ave	S. from Gratiot.
d ave.	Belleview and Cleveland	N. from Harper.
ve.	Whitaker st	E. from Russell.
st.	Willis ave	E. from Van Dyke.
ave	Seventeenth st	N. from Grand River.
ave.	Trumbull ave	N. from Holden.
st.	Superior st	E. from Van Dyke.
	Superior st	E. & W. from Concord.
t.	Gladstone st	E. from Vinewood.
st.	Alexandrine and De Vogaelaer	E. from Van Dyke.
ve.	Raymond ave	W. from Woodward.
th st.	Laferty st	S. from Howard.
	Parker st	E. &W. from VanDyke.
e st.	Sargent st	E from Baldwin.
e.	Wilkins ave	W. from Woodward.
n ave.	Reutter st	E. from Russell.
st.	Frederick st	E. from Baldwin.
t.	Endicott ave	E. from Lincoln ave.
st.	Hancock ave	E. from Van Dyke.
t.	Harper	E. from McClellan.

PIPEAGE OF THE CITY OF DETROIT,

ALPHABETED BY STREETS, SHOWING THE SIZE OF IRON AND WOOD PIPE IN USE.

LOCATION.	DIAM. INCHES.	KIND.
A st., Vinewood to Hubbard	4	iron.
" e. from Scotten 78 ft	4	"
Aberle ave., e. from Russell 349 ft	4	"
Abbott st., Cass to Tenth	24	"
" w. from Third 20 ft	6	"
" alley s. of, from Cass to w. line of Lognon farm	4	"
" alley s. of, crossing Sixth	6	"
" alley n. of, from First to Twelfth	4	"
Adair st., the River to Jefferson	6	"
Adams ave., John R. to Randolph	6	"
" Witherell to Hastings	4	"
" alley s. of, from 240 ft. e. of Clifford to Cass	4	"
" alley n. of, from Woodward to 100 ft. w. of Cass	4	"
Adelaide st., Woodward to Orleans	4	"
" e. from Orleans 36 ft	18	"
" 36 ft. e. of Orleans to Gratiot	10	"
" crossing Gratiot	8	"
Agnes ave., E. Boulevard to Field	4	"
Albert st., Wesson to Hammond	6	"
Alexandrine ave., Woodward to Cass	6	"
" Cass to Third	4	"
" w. from Fourth 150 ft	3	"
" 150 ft. w. of Fourth to Greenwood	4	"
" Sixth to Seventh	4	"
" Seventh to alley w. of Trumbull	6	"
" alley w. of Trumbull to alley w. of Commonwealth	4	"
" crossing Grand River	6	"
" Woodward to Beaubien	4	"
" Beaubien to St. Antoine	3	"
" St. Antoine to Russell	6	"
" crossing St. Antoine w. side	4	"
" Russell to alley west of Dubois	4	"
" alley w. of Dubois to Chene and crossing Grandy	3	"
" w. line of Chene to w. line of Grandy	4	"
" McDougall to alley e. of	6	"
" alley e. of McDougall to 401 ft. e. of Moran	4	"
Alfred st., Woodward to Russell	4	"
" Russell to Orleans	3	"
" Orleans to Dubois	4	"
Alger ave., 16-in. main to e. line of Woodward	6	"
" e. from Woodward 514 ft	4	"
" Russell to 443 ft. e. of Greeley	6	"
Amherst st., w. from Junction 314 ft	4	"
" crossing Campbell	6	"
Amsterdam st., crossing Woodward w. side and from e. to w. line Cass.	4	
" w. line of Woodward to e. line of Cass	6	

LOCATION.	DIAM. INCHES.	KIND.
nnexation st., e. from Junction 558 ft	4	Iron
nthon st., w. from Junction 360 feet	4	“
“ 360 ft. w. of Junction to 260 ft. west of Campbell	6	“
ntietam st., Rivard to 22 ft. w. of McDougall	4	“
ntoinette st., crossing Cass and Second	4	“
“ e. from Second 165 ft	3	“
“ w. from Twelfth 193 ft	4	“
“ w. from Wabash 138 ft	4	“
“ 138 ft. w. of Wabash to Fourteenth	6	“
“ w. from Fourteenth 223 ft	4	“
“ 223 ft. w. of Fourteenth to Fifteenth	6	“
“ crossing Eighteenth, e. side	4	“
Arlington pl., Woodward to Cass	4	“
Arndt st., Gratiot to 20 ft. e. of alley e. of McDougall	6	“
“ alley e. of McDougall to Elmwood	3	“
“ Elmwood to Mt. Elliott	4	“
Artillery ave., n. from River st. 515 ft	6	“
“ crossing Fort, and 78 ft. s. of to n. line of Lafayette	6	“
“ s. from Dix 477 ft	8	“
Ash st., Grand River to alley e. of Trumbull	4	“
“ alley w. of Trumbull to National	6	“
“ Harrison to Twelfth	4	“
“ Twelfth to alley e. of Wabash	6	“
“ w. from Wabash 148 ft	4	“
“ crossing Fifteenth and Sixteenth	4	“
“ Sixteenth to Seventeenth	4	“
“ Seventeenth to Eighteenth	3	“
“ e. line of Eighteenth to alley w. of	4	“
“ e. from Humboldt 166 ft	3	“
“ Humboldt to Sullivan	4	“
“ w. from Sullivan 214 ft	3	“
“ e. from Maybury 250 ft	4	“
“ e. line of Tillman to Twenty-fourth	4	“
“ Twenty-seventh to Vinewood	4	“
Atkinson ave., 16-in. main to 21 ft. w. of Woodward	6	“
Atwater st., Griswold to Shelby	3	“
“ Griswold to Bates	6	“
“ Randolph to 215 ft. e. of St. Aubin	4	“
“ 215 ft. e. of St. Aubin to McDougall	6	“
“ alley s. of, alley w. of Bates to Randolph	4	“
Audrain st. (in line of), Clippert to Michigan Brass and Iron Works, 1,808 ft	4	“
Aurelia st., Twelfth to w. line of Thirteenth	4	“
Avery ave., crossing Grand River	6	“
“ alley s. of Lysander to 125 ft. n. of Putnam	6	“
“ Merrick to 345 ft. n. of Kirby	6	“
“ s. from Piquette 104 ft	6	“
“ alley w. of Lysander to Bunclark court	6	“
B st., w. from Vinewood 313 ft	4	“
Bagg st., Woodward to Fifteenth	24	“
“ Fifth to e. line of Greenwood	3	“
“ crossing Greenwood e. side	4	“
Bagley ave., Park to Clifford	4	“
“ alley e. of, from alley n. of Park to Cass	4	“
“ alley w. of, 230 ft. n. of Clifford to Grand River	4	“
Baker st., Seventh to Twenty-fourth	8	“

LOCATION.	DIAM. INCHES.	KIND.
Baker st., Seventh to Eighth	4	iron.
" Twenty-fourth to Vinewood	4	"
" crossing Twenty-fifth and Vinewood e. side 29 ft	6	"
" Hubbard to Scotten	4	"
" alley s. of, Wabash to Fourteenth	4	"
Baldwin ave., Jefferson to 119 ft. s. of Waterloo	6	"
" Mack to s. line of Warren	10	"
" s. of Gratiot 223 ft	10	"
" Gratiot to Harper	8	"
Baltimore ave., Woodward to w. line of Greenwood	4	"
" w. line of Greenwood to Lincoln	6	"
" w. from Sullivan 297 ft	4	"
" Woodward to w. line of Brush	3	"
" crossing Brush w. side 41 ft	6	"
Bancroft ave., 16-in. main to w. line of Woodward	6	"
Bates st., Atwater to Farmer	6	"
" Congress to Champlain	30	"
Beacon st., Brush to 211 ft. e. of St. Antoine	4	"
Beals ave., s. from Mack 1,628 ft	6	"
Beaman st., Crane to alley w. of	4	"
Beaubien st., Atwater to Clinton	6	"
" crossing Champlain and Gratiot	8	"
" Clinton to Watson	4	"
" Watson to Harper	10	"
" Harper to s. line of N. Boulevard	6	"
" s. to n. line of N. Boulevard	10	"
" s. from Custer 112 ft	6	"
Beaufait ave., n. from Jefferson 585 ft	6	"
" 585 ft. n. of Jefferson to 282 ft. n. of St. Paul	4	"
" 282 ft. n. of St. Paul to 263 ft. n. of Kercheval	6	"
" Mack to 295 ft. s. of Gratiot	6	"
" Gratiot to 190 ft. n. of Forest	6	"
" crossing N. Boulevard	6	"
Beaver st., Twenty-seventh to Vinewood	4	"
Beech st., First to Seventh	4	"
Bellevue ave., Jefferson to s. line of Superior	6	"
" crossing Gratiot	6	"
" Gratiot to 30 ft. s. of Farnsworth	4	"
" crossing N. Boulevard	8	"
Belmont ave., 16-in. main to e. line of Woodward	6	"
Belvidere ave., 67 ft. s. of, to 535 ft. n. of Lorman	6	"
Benton st., Brush to Russell	4	"
Berlin st., Gratiot to Jos. Campau	3	"
" Jos. Campau to alley w. of McDougall	6	"
" crossing Jos. Campau and Elmwood	4	"
" alley e. of McDougall to Elmwood	3	"
" Ellery to Mt. Elliott	4	"
Bethune ave., Woodward to Hamilton Boulevard	6	"
Biddle st., Twenty-seventh to 190 ft. e. of Vinewood	4	"
Blaine ave., 16-in. main to w. line of Woodward	6	"
" w. from Woodward 1,616 ft	4	"
Boone st., crossing Collins	6	"
" w. from Collins 314 ft	4	"
" w. from Moran 284 ft	4	"
" crossing E. Boulevard e. side 31 ft	6	"
Boston Boulevard, crossing Woodward e. from 16-in. main	6	"

LOCATION.	DIAM. INCHES.	KIND.
vard East (e. side), 255 ft. s. of Jefferson to Congress	6	iron.
(w. side), s. from 42-in. main in Jefferson 94 ft	10	“
(e. side), s. from Agnes 121 ft	6	“
(w. side), Jefferson ave. main to n. line	6	“
(w. side), n. from St. Paul 52 ft	6	“
just s. of Mack crossing E. Boulevard 76 ft	6	“
‘ (e. and w. sides), from Mack ave. main to the n. line	4	“
‘ (e. side), s. of Gratiot 29 ft	4	“
‘ (e. side), n. of Gratiot 53 ft	6	“
“ (w. side), s. of Gratiot 37 ft	6	“
“ (w. side), n. of Gratiot 48 ft	6	“
“ (w. side), crossing Farnsworth, Ferry and N. Boulevard	8	“
“ (e. side), crossing Farnsworth and N. Boulevard	6	“
ilevard North (n. side), crossing Frontenac	8	“
“ (both sides), crossing Helen, Canton and Concord	6	“
“ (both sides), crossing Bellevue, Beaufait and Meldrum	6	“
“ (both sides), crossing Mt. Elliott, Ellery and Moran	6	“
“ (both sides), crossing Collins	6	“
ulevard East (both sides), crossing Henry, Medbury and Piquette	6	“
“ (e. side), crossing Harper, Boone and Kanter	6	“
ulevard North, Collins to Grand River	24	“
“ e. from Mitchell 68 ft	4	“
“ Grand River to 14 ft. w. of West Boulevard	16	“
“ (s. side), Woodward to 100 ft. e. of Rivard	4	“
“ (n. side), crossing Woodward	6	“
“ w. from Eighteenth 228 ft	6	“
“ (n. side), e. from Grand River 600 ft	4	“
“ (s. side), crossing Cass and Fourteenth	4	“
“ (s. side), crossing Greenwood e. side	4	“
“ (both sides), crossing Eighteenth	4	“
“ (s. side), from e. line to 361 ft. w. of Twelfth	4	“
“ (s. side), from e. line of Grand River to e. side of W. Boulevard	4	“
Boulevard West (e. side), s. from N. Boulevard 161 ft	4	“
“ (e. side), from 161 ft. s. of N. Boulevard to s. line of Scovel pl	6	“
“ (w. side), s. from N. Boulevard 117 ft	6	“
“ (w. side), 430 ft. n. of Warren to 650 ft. s. of same	6	“
“ (both sides), crossing Scovel, Moore and Wreford	6	“
“ (both sides), crossing McGraw, Hancock and Buchanan	6	“
“ (e. side), McGraw to Warren, n. line	6	“
“ (e. side), crossing Warren	4	“
“ (e. side), Hancock to Buchanan	6	“
“ alley e. of Twenty-Seventh to Hubbard	6	“
“ Myrtle to Michigan	6	“
“ crossing Michigan	6	“
“ (w. side), s. from Michigan 444 ft	4	“
“ (w. side), from n. line of Toledo to n. line of Dix	4	“
“ (e. side), 196 ft. n. of Toledo to Baker	6	“
“ (w. side), Baker to Shady lane	3	“
“ (both sides), Shady lane to Fort	4	“
Bowen ave., Jefferson to 50 ft. s. of Chapaton	6	“
Bradley st., w. from Crane 211 ft	4	“
Brady st., Woodward to Beaubien	6	“
“ Beaubien to Russell	4	“
Brainard st., Cass to Third	4	“

LOCATION.	DIAM. INCHES.	KIND.
Brainard st., Third to Fourth	6	iron.
" Fourth to alley w. of	4	"
" alley w. of Fourth to Greenwood	3	"
" Sixth to Seventh	4	"
" e. line of Seventh to Trumbull	6	"
Brandon ave., Hubbard to Junction	4	"
" Junction to Campbell	6	"
Bratshaw st., Third to Fourth	6	"
Breckenridge st., w. from Fourteenth 140 ft	4	"
" 140 ft. w. of Fourteenth to Fifteenth	6	"
" w. from Sixteenth 148 ft	6	"
" 148 ft. w. of Sixteenth to Eighteenth	4	"
" Eighteenth to Humboldt	6	"
" w. from Humboldt 74 ft	4	"
Brevoort pl., alley w. of Eighteenth to Nineteenth	4	"
" Twenty-second to alley e. of	6	"
Brewster st., Brush to Russell and Riopelle to Gratiot	4	"
Bristol pl., Twenty-first to Twenty-second	4	"
Bruce st., w. from Crane 238 ft	4	"
Brush st., Atwater to Jefferson	6	"
" crossing Jefferson	8	"
" Jefferson to Congress	4	"
" Congress to Gratiot	8	"
" Gratiot to Wilkins and crossing Eliot and Rowena	4	"
" Edmund to Watson	24	"
" Watson to Benton	6	"
" (both sides), crossing Palmer	4	"
" Alexandrine to 230 ft. n. of Milwaukee	6	"
" 230 ft. n. of Milwaukee to 24-inch main in N. Boulevard	8	"
" Horton to Hamlin	4	"
" crossing Chandler	6	"
Bryant st., Twelfth to 125 ft. e. of Wabash	4	"
" e. from Wabash 125 ft	6	"
Buchanan st., Grand River to Vinewood	30	"
" Vinewood to Livernois	16	"
" Wabash to Fifteenth	4	"
" w. from Seventeenth 169 ft	4	"
" Eighteenth to 387 ft. w. of Humboldt	4	"
" 75 ft. e. of Sullivan to e. line of Maybury	3	"
" e. line of Maybury to Williams	4	"
" Twenty-third to w. line of Twenty-fourth	4	"
" Scotten to Twenty-eighth	4	"
" alley s. of Joe to Howell	6	"
Bunclark court, Twelfth to alley w. of Avery	6	"
Burlage pl., Waterloo to Cleveland	8	"
Bushey st., Michigan to Julia	6	"
Butternut st., Seventh to alley e. of Trumbull	4	"
" alley w. of Trumbull to National	4	"
" e. from Wabash 263 ft	4	"
" e. from Seventeenth 144 ft	4	"
" 227 ft. e. of Maybury to Williams	4	"
" Fifteenth to Twenty-fourth	24	"
C st., Vinewood to Hubbard	4	"
Cadillac ave., Pumping Works to Mack	42	"
" crossing Jefferson to n. line	6	"
" 1,000 ft. n. of, to 2,050 ft. n. of Jefferson	6	"

LOCATION.	DIAM. INCHES.	KIND.
ave., s. from Harper 95 ft.	6	iron.
quare (s. side), Woodward to Randolph	24	"
(n. side), Monroe to Bates	6	"
alley n. of, alley w. of Bates to Randolph	4	"
ave., Third to Grand River	30	"
Fourth to Eighth and crossing Lincoln	4	"
w. line to 196 ft. e. of Twelfth	4	"
ve., crossing Woodward to w. side	6	"
ave., 24-inch main to 132 ft. n. of N. Boulevard	6	"
132 ft. n. of N. Boulevard to Clay	4	"
Clay to 23 ft. n. of Koch	6	"
st., River st. to Fort	6	"
n. from Dix 448 ft	4	"
l ave., River st. to Porter	6	"
s. line of Dix to Dunn	6	"
Jackson to 161 ft. n. of Herbert	6	"
ave., Woodward to Third	30	"
Woodward to Third	4	"
Fourth to Greenwood	4	"
Sixth to e. line of Seventh	3	"
crossing Seventh	4	"
Twelfth to 48 ft. e. of Thirteenth	3	"
e. from Thirteenth 48 ft	4	"
Woodward to Collins	42	"
Woodward to 767 ft. w. of Mt. Elliott	6	"
w. from Mt. Elliott 767 ft.	4	"
Canton to 9 ft. w. of Helen	6	"
alley s. of, e. from Hastings 331 ft	3	"
alley n. of, e. from Hastings 335 ft	3	"
alley n. of, e. from Second 150 ft.	3	"
e., 16-in. main to w. line of Woodward	6	"
w. from Woodward 27 ft.	4	"
ve., Jefferson to 210 ft. n. of Kercheval	6	"
crossing Mack and s. from Gratiot 1,052 ft	6	"
65 ft. n. of Hancock to 168 ft. n. of Frederick	6	"
crossing N. Boulevard and s. from Piquette 266 ft	6	"
st., w. from Twelfth 192 ft	3 & 4	"
192 ft. w. of Twelfth to Thirteenth	6	"
Woodbridge to Jefferson	8	"
Jefferson to Fort	24	"
alley n. of Michigan to Spencer	4	"
alley w. of, Spencer to Lewis	4	"
alley w. of, from alley n. of Adams to 119 ft. s. of Gilman	4	"
alley w. of, s. from Gilman 119 ft	3	"
, Jefferson to Columbia and Gilman to Joy	10	"
Columbia to Gilman	16	"
Joy to Alexandrine and crossing Canfield	8	"
Alexandrine to 118 ft. s. of D. & B. C. R. R	6	"
118 ft. s. of D. & B. C. R. R. to Milwaukee	8	"
s. line of N. Boulevard to 24-in. main	8	"
w. side, crossing Forest and Putnam	4	"
alley w. of, Ledyard to Bagg	4	"
e st., Gratiot to Rivard	4	"
crossing Rivard	6	"
Rivard to Dequindre	4	"
Dequindre to St. Aubin	3	"
St. Aubin to Elmwood	4	"
ave., 416 ft. s. of Cadet to n. line of Dix	6	"

LOCATION.	DIAM. INCHES.	KIND.
Cavalry ave., n. line of Dix to Toledo	4	iron.
Celeron st., Junction to 274 ft. w. of Campbell	4	"
Celia st., Twelfth to Thirteenth	4	"
" Thirteenth to 4 ft. e. of Wabash	3	"
" Wabash to 4 ft. e. of e. line	4	"
Champlain st., Randolph to St. Aubin	30	"
" Randolph to alley e. of	4	"
" St. Antoine to Orleans	4	"
" Orleans to Elmwood	6	"
" Elmwood to 250 ft. w. of Lieb	4	"
" w. from Lieb 250 ft.	3	"
" Lieb to Field	4	"
" crossing E. Boulevard	6	"
" Field to e. line of Baldwin	6	"
" Seyburn to Shipherd	6	"
" alley n. of, Brush to St. Antoine	4	"
Chandler ave., Woodward to w. line of Oakland	6	"
Charles st., Sixth to Seventh	4	"
Charlevoix st., Chene to e. line of Jos. Campau	4	"
" Jos. Campau to alley w. of McDougall	3	"
" alley e. of McDougall to Elmwood	4	"
" Ellery to Mt. Elliott and w. from Concord 142 ft	4	"
Charlotte ave., Woodward to alley e. of Third	4	"
" w. from Fourth 131 ft	3	"
" 131 ft. w. of Fourth to Fifth	4	"
Chase st., e. line of Russell to w. line of Riopelle	3	"
" crossing Russell e. side and Riopelle w. side	4	"
Chene st., Congress to Canfield	30	"
" Atwater to s. line of N. Boulevard	6	"
Cherry st., Grand River to Seventh	16	"
" Seventh to alley w. of Trumbull	4	"
" alley w. of Trumbull to National	3	"
" Harrison to Twelfth	4	"
Chestnut st., Russell to Elmwood	4	"
Chipman st., alley w. of Eighteenth to Nineteenth	4	"
Chicago Boulevard, crossing Woodward from 16-inch main to e. line	6	"
Chope pl., s. from Grand River 167 ft	4	"
" 167 ft. s. of Grand River to Twenty-fourth	6	"
Christiancy st., e. from Lansing 134 ft	4	"
" w. from Ferdinand 135 ft	6	"
Church st., crossing Tenth to 170 ft. w	4	"
" crossing Eleventh	4	"
" alley s. of Eighth to Tenth	4	"
Clairmont ave., 16-inch main to w. line of Woodward	6	"
" w. from Woodward 1,275 ft	4	"
" w. from Hamilton Boulevard 175 ft	6	"
Clark ave., River st. to s. line of M. C. R. R.	8	"
" s. line of M. C. R. R. to Michigan	6	"
" Michigan-Peninsular Car Works to Michigan	4	"
" in Car Works' grounds	6	"
Clark pk., w. from Scotten 292 ft	4	"
" e. from Clark 282 ft	4	"
" n. and s. from 4-inch pipe 607 ft	3	"
Clay ave., Woodward to Oakland and n. of Clay, crossing Woodward connecting 8 and 16-inch mains	8	"
" Oakland to 393 ft. e. of St. Aubin	6	"

LOCATION.	DIAM. INCHES.	KIND.
st., St. Aubin to Elmwood	10	iron.
Elmwood to Burlage pl.	8	“
pl., crossing Greenwood (e. side)	4	“
e. from Greenwood 264 ft	3	“
alley n. of, crossing Greenwood (e. side)	4	“
alley n. of, from Greenwood to alley w. of Fourth	3	“
st., e. line of Woodward to Washington	12	“
alley w. of Griswold to e. line of Washington	4	“
Park pl. to Sproat	4	“
st., Gratiot to Rivard	10	“
Rivard to Orleans	16	“
and ave., Orleans to Elmwood	8	“
st., n. from Dennis 481 ft.	4	“
, Van Dyke to Parker	6	“
, crossing Russell (e. side)	4	“
st., Gratiot to Canfield	42	“
Canfield to Griffin	30	“
Leland to Canfield	4	“
n. from Canfield 563 ft	3	“
563 ft. n. of Canfield to 26 ft. n. of Hancock	4	“
s. from Harper 150 ft.	6	“
st., Woodward to Park	4	“
Park to Cass	16	“
Woodward to John R.	6	“
John R. to Beaubien	4	“
Beaubien to Rivard	6	“
alley s. of, Woodward to Cass	6	“
ave., s. from Fort 570 ft.	3	“
crossing Fort	4	“
wealth ave. (w. side). Alexandrine to Calumet and crossing Grand River	6	“
crossing Forest 42 ft.	12	“
(both sides), n. to s. line of Hancock	6	“
s. line to 168 ft. n. of Putnam	6	“
Kirby to 7 ft. n. of Stanley	6	“
439 ft. s. of Piquette to Holden	6	“
ave., Jefferson to 110 ft. n. of Waterloo	6	“
320 ft. s. of Charlevoix to Mack	6	“
Sylvester to s. line of Harper	6	“
st., Bates to Sixth	30	“
Randolph to St. Aubin	24	“
St. Aubin to Meldrum	42	“
Bates to Brush	4	“
St. Antoihe to Mt. Elliott	4	“
w. from Helen 171 ft.	4	“
e. side of E. Boulevard to Field	4	“
alley s. of, from Griswold to Third	4	“
alley s. of, e. from Fourth 250 ft.	4	“
alley s. of, Sixth to Seventh	4	“
alley s. of, 80 ft. w. of Brush to St. Antoine	4	“
alley n. of, from alley w. of Woodward to Shelby	4	“
alley n. of, Shelby to Cass	6	“
alley n. of, Cass to 10 ft. w. of Third	4	“
alley n. of, Fifth to Seventh	8	“
alley n. of, Seventh to Eighth	4	“
alley n. of, alley e. of Woodward to Bates	4	“

LOCATION.	DIAM. INCHES.	KIND.
Congress st., alley n. of, alley w. of Brush to St. Antoine	4	iron.
" alley n. of, alley e. of Woodward e. 94 ft	3	"
Cook st., e. from Welch 289 ft	4	"
Cracow pl., w. from Rivard 361 ft	6	"
Craig ave., n. from Trombly 378 ft	3	"
Crane ave., Jefferson to Mack	8	"
Crary st., w. from Crane 211 ft	4	"
Cross st., alley n. of, John R. to Randolph	4	"
Crystal st., Trombly to Milwaukee	4	"
Custer ave., e. from Woodward 298 ft	4	"
" e. from John R 307 ft	4	"
" 307 ft. e. of John R to Brush	6	"
" Brush to Hastings	4	"
" e. from Rivard 126 ft	4	"
Cutler st., e. from McClellan 481 ft	4	"
D st., w. from Vinewood 300 ft	4	"
Dalzelle st., crossing Twelfth	4	"
" Twelfth to Thirteenth	3	"
" Foundry to Twenty-second	4	"
" Twenty-second to Twenty-third	6	"
" Twenty-third to Twenty-fourth	4	"
Dane st., crossing Collins e. side	6	"
" e. line of Collins to 338 ft. e. of Moran	4	"
Davenport st., Woodward to Cass	4	"
Davis pl., s. from Theodore 260 ft	4	"
Deming st., e. from Scotten 368 ft	4	"
Dennis st., Livernois to Clippert	4	"
Dequindre st., Woodbridge to Jefferson	6	"
" w. side Jay to Waterloo	4	"
" e. side Waterloo to Gratiot	4	"
" s. from Adelaide 206 ft	4	"
" Alfred to Pierce	4	"
" Canfield to Willis	4	"
Detloff ct., crossing Hancock, n. side	4	"
" n. line of Hancock to 270 ft. n	3	"
Devereaux st., Thirtieth to Thirty-first	6	"
Dillon ave., n. from Holden 687 ft	6	"
Division st., Brush to St. Aubin	4	"
Dix ave., crossing Twenty-third	6	"
" (n side), crossing W. Boulevard 130 ft	6	"
" Twenty-fourth to Artillery	10	"
Dragoon ave., n. from River st. 563 ft.	6	"
" s. line of Fort to n. line of Dix	6	"
Driggs ave., Junction to Campbell	4	"
" crossing Campbell (west side)	6	"
Dry Dock st., Swain to Lady's lane	4	"
Dubois st., Atwater to Clinton	6	"
" Clinton to Hunt	8	"
" Hunt to n. line of Leland	6	"
" n. line of Leland to Canfield	3	"
" Canfield to 188 ft. n. of Frederick	4	"
" 188 ft. n. of Frederick to Ferry	6	"
" Ferry to Hendrie	4	"
" Hendrie to 100 ft. s. of Medbury	6	"
" 100 ft. s. of Medbury to 20 ft. s. of Harper	4	"
" 20 ft. s. of Harper to 102 ft. n. of Piquette	8	"

LOCATION.	DIAM. INCHES.	KIND.
crossing N. Boulevard	8	iron.
, Woodward to Cass	4	"
st., e. from Crane 297 ft.	4	"
297 ft. e. of Crane to 336 ft. e.	6	"
ampbell to Wesson	3	"
wood to Hubbard	4	"
ty-sixth to e. line of W. Boulevard	4	"
, 16-inch main to w. line of Woodward	6	"
t., Woodward to Brush	24	"
River st. to alley s. of Fort	4	"
Fort to alley n. of	2¼	wood.
Baker to Cherry	4	iron.
Grand River to Calumet	8	"
crossing Calumet s. side 40 ft.	6	"
Calumet to Lysander	4	"
st., Fort to 50 ft. n. of Linden	6	"
50 ft. n. of, to 370 ft. n. of Linden	3	"
370 ft. n. of, to 468 ft. n. of Linden	4	"
468 ft. n. of Linden to n. line of Buchanan	6	"
n. line of Buchanan to s. line of Hancock	4	"
crossing Hancock (s. side)	6	"
Grand River to s. side of N. Boulevard	6	"
crossing N. Boulevard	8	"
n. from N. Boulevard 228 ft.	6	"
alley w. of, Brevoort to Webster pl.	4	"
alley w. of, St. Clair to Wing pl.	4	"
alley w. of, Chipman to Johnson	4	"
-and-a-half st., s. from River st. 504 ft.	8	"
River st. to Fort	4	"
., Leverette to Michigan	6	"
oodward to Riopelle	4	"
Arndt to Berlin	6	"
Heidelberg to Snyder pl.	6	"
Mack to Pulford	6	"
Zender to Gratiot	6	"
crossing N. Boulevard	6	"
Forest to Hancock	3	"
t., both sides, alley e. of Woodward to 200 ft. w. of Brush	4	"
200 ft. w. of Brush to Hastings	4	"
alley s. of, alley e. of Woodward to Witherell	3	"
Cass to Grand River	8	"
venth to alley e. of Trumbull	4	"
ey w. of Trumbull to National	4	"
tional to Harrison	6	"
rrison to alley e. of Wabash	4	"
ve., Jefferson to Monroe and Waterloo to Hunt	4	"
Monroe to Maple and Hunt to Gratiot	6	"
., McClellan to Pennsylvania	4	"
ve., crossing Woodward e. side	4	"
ave., 16-in. main to e. line of Woodward	6	"
e. line of Woodward to w. line of Oakland	4	"
e. from w. line of Oakland 30 ft.	6	"
, Woodward to Russell	4	"
Russell to 159 ft. w. of Riopelle	6	"
w. from Riopelle 159 ft.	4	"
Dequindre to w. line of Chene	4	"
w. line of Chene to Grandy	8	"

LOCATION.	DIAM. INCHES.	KIND.
Euclid ave., w. from Woodward 520 ft	6	iron.
Exposition grounds, s. from River st. 948 ft	4	"
F st., w. from Vinewood 140 ft	4	"
Fairbanks st., e. from Scotten 364 ft	4	"
Farmer st., Bates to Gratiot	6	"
" 15 ft. s. of to 38 ft. n. of 30-in. main in Gratiot	8	"
Farnsworth ave., Woodward to Beaubien and crossing Rivard	6	"
" Beaubien to Russell	4	wood.
" Russell to Grandy and Mitchell to McDougall	4	iron.
" crossing Collins	6	"
" Collins to Moran	3 & 4	"
" w. from Concord 162 ft	6	"
" Canton to Helen	4	"
" crossing E. Boulevard	6	"
Farrand st., e. from McClellan 513 ft	6	"
Ferdinand st., n. from River st. 975 ft	4	"
" s. from Fort 480 ft	4	"
" Porter to 140 ft. n. of Christiancy	6	"
" 360 ft. s. of to 309 ft. n. of Dix	6	"
Ferry ave., Woodward to Russell	4	"
" Russell to St. Aubin	8	"
" St. Aubin to Mitchell	4	"
" w. from Collins 60 ft	6	"
" w. line of to 82 ft. e. of Collins and crossing E. Boulevard	8	"
" w. from Moran 247 ft	4	"
" alley s. of, from alley w. of St. Aubin w. 168 ft	4	"
Field ave., Jefferson to 740 ft. n. of Waterloo	6	"
" 4 ft. s. of Mack to 177 ft. n. of Medbury	6	"
Fifth st., Congress to alley n. of	8	"
" alley s. of to alley n. of Lafayette	4	"
" Labrosse to alley s. of Michigan	4	"
" Michigan to Noble	4	"
" both sides of Elton and Crawford parks	4	"
" Holden to 144 ft. s. of Piquette	4	"
" alley e. of, Labrosse to alley s. of Michigan	4	"
Fifteenth st., Fort to n. line of Grand River	6	"
" Bagg to Buchanan	24	"
" n. from Warren 348 ft	6	"
" Kirby to Harper and crossing N. Boulevard	6	"
Finley st., w. from Jos. Campau 433 ft	4	"
First st., Front to Jefferson	6	"
" Jefferson to alley n. of and crossing Congress	8	"
" Woodbridge to Fort	4	"
" Fort to Grand River	6	"
" alley e. of, from alley n. of Michigan to Spencer	4	"
Fischer ave., Jefferson to 90 ft. n. of Sherman	6	"
" n. from Mack 1,483 ft	6	"
Florence st., Harper to Piquette	4	"
Florene st., Shipherd to Van Dyke	6	"
Flower st., crossing Forest n. s	4	"
" n. from Forest 260 ft	3	"
Forest ave., Woodward to Cass	4	"
" (both sides) Cass to Third	4	"
" Fourth to Seventh and crossing Trumbull	4	"
" Trumbull to Commonwealth	8	"
" Commonwealth to Avery	6	"

LOCATION.	DIAM. INCHES.	KIND.
Forest ave., Avery to 190 ft. w. of Twelfth	4	iron.
“ 190 ft. w. of Twelfth to Thirteenth	6	“
“ alley w. of Wabash to Fourteenth	6	“
“ Woodward to 373 ft. w. of Rivard	4	“
“ w. from Rivard 373 ft	6	“
“ Russell to 190 ft. w. of Grandy	4	“
“ e. line of Grandy to 190 ft. w	6	“
“ McDougall to e. line of Collins	6	“
“ Collins to Moran	4	“
“ Thompson ct. to 124 ft. w. of Ellery pl.	6	“
“ 124 ft. w. of Ellery pl. to Mt. Elliott	4	“
“ w. from Beaufait 157 ft	4	“
“ e. from Baldwin 164 ft	4	“
“ alley n. of, crossing Orleans w. side	4	“
“ alley n. of, w. line of Orleans to alley e. of Riopelle	8	“
Forsyth ave., crossing Baltimore 33 ft. s. side	6	“
Fort st., Woodward to Griswold	4	“
“ Woodward to Seventh	16	“
“ Seventh to Fourteenth	6	“
“ Fourteenth to Hoffman	8	“
“ Hoffman to Twenty-fourth	6	“
“ Twenty-fourth to w. line of Artillery	8	“
“ St. Antoine to Meldrum	4	“
“ w. from Helen 168 ft.	4	“
“ alley n. of, w. from Brush 135 ft	4	“
“ alley n. of, Brush to St. Antoine	4	“
Foundry st., Baker to Michigan	6	“
Fourth st., Woodbridge to Larned	4	“
“ Larned to Congress	8	“
“ Fort to Grand River	6	“
Fourth ave., Grand River to Bagg	4	“
“ Bagg to Calumet	6	“
“ Calumet to Holden	4	“
“ alley w. of, Brainard to alley n. of	4	“
“ alley w. of, Selden to alley s. of	4	“
Fourteenth ave., Fort to Lafayette and Bagg to Grand River	8	“
“ (w. side), n. from Porter 402 ft	4	“
“ Lafayette to Bagg	10	“
“ Grand River to s. line of N. Boulevard	6	“
“ s. to n. line of N. Boulevard	8	“
Fox st., Frank to Alexandrine	3 & 4	“
Frank st., Fourth to 114 ft. w. of Sixth	4	“
“ 114 ft. w. of Sixth to 75 ft. w. of Fox	3	“
Franklin st., Randolph to Beaubien	4	“
“ Beaubien to Orleans	6	“
“ Orleans to 25 ft. e. of Dequindre	4	“
“ 25 ft. e. of Dequindre to McDougall	6	“
“ Walker to Adair and w. from Leib 325 ft	4	“
“ alleys n. and s. of, McDougall to Walker	4	“
Frederick ave., Woodward to 124 ft. e. of Riopelle	4	“
“ 124 ft. e. of Riopelle to 139 ft. e	6	“
“ 252 ft. w. of St. Aubin to Jos. Campau	4	“
“ crossing Collins and e. of Moran 126 ft	6	“
“ Helen to E. Boulevard	4	“
Fremont pl. (alley n. of Willis), Collins to 443 ft. w. of Moran	6	“
“ w. from Moran 443 ft	4	“

LOCATION.	DIAM. INCHES.	KIND.
Front st., 170 ft. e. of First to Second	4	iron.
" e. from Third 107 ft	6	"
" alley n. of, Second to Third	4	"
Frontenac ave., crossing n. side of N. Boulevard	8	"
" s. from Medbury 93 ft	6	"
Galster st., Canfield to Garfield	6	"
Garfield ave., Woodward to w. line of Brush farm	4	"
" w. line of Brush farm to 10 ft. w. of Brush	6	"
" 10 ft. w. of Brush to e. line	4	"
" e. line of Brush to 222 ft. w. of Beaubien	6	"
" 222 ft. w. of Beaubien to e. line of St. Antoine	4	"
" e. line of St. Antoine to 346 ft. w. of Hastings	6	"
" w. from Hastings 346 ft	3	"
" Hastings to Chene	4	"
" Chene to Grandy	6	"
" crossing Grandy, and e. from McDougall 218 ft	4	"
" crossing Collins and from 213 ft. w. of Moran to 188 ft. w. of Galster	6	"
" w. from Moran 213 ft. and w. from Beaufait 182 ft	4	"
" alleys n. and s. of, w. from Hastings 374 ft	4	"
Gilman st., Cass to Grand River	16	"
Gladstone ave., 16-inch main to 803 ft. w. of Woodward	6	"
Glynn ct., 16-inch main to w. line of Woodward	6	"
" w. from Woodward 300 ft	4	"
Goethe st., Crane to Holcomb and e. from McClellan 228 ft	4	"
Goldner ave., Michigan to G. T. Ry	6	"
Grand River ave., Woodward to Cass	8	"
" Cass to Third	6	"
" Third to 400 ft. w. of Humboldt	8	"
" 400 ft. w. of Humboldt to Vinewood	6	"
" Vinewood to N. Boulevard	10	"
Grand River ave., N. Boulevard to city limits	6	"
" Calumet to Buchanan	30	"
" connecting 30-inch and 8-inch mains in Buchanan 22 ft.	8	"
" (s. side), Second to 56 ft. e. of Cherry	4	"
" (n. side), e. from Eighth 110 ft	3	"
" alley n. of, 10 ft. w. of Bagley to alley w. of	4	"
" alley n. of, Fourth to Union and w. from Lincoln 47 ft.	4	"
" alley n. of, 47 ft. w. of Lincoln to alley w. of	2¼	wood.
" alley n. of, Trumbull to alley w. of and Wabash to alley w. of	6	iron.
Grandy ave., Gratiot to Pierce	8	"
" Pierce to Harper	6	"
" n. from Harper 322 ft	4	"
" 322 ft. n. of Harper to Chene	6	"
Granger st., e. from Baldwin 259 ft	6	"
" 259 ft. e. of Baldwin to Van Dyke	4	"
Grant ct., n. from Warren 318 ft	4	"
Grant st., crossing Twelfth w. side	4	"
" Twelfth to Thirteenth	3	"
Granville pl., Thirteenth to Wabash e. line	3	"
" crossing Wabash to e. line	4	"
Gratiot ave., Woodward to Raynor	30	"
" Woodward to Brush	10	"
" Brush to 64 ft. w. of Sheridan	6	"
" 64 ft. w. of Sheridan to 266 ft. w. of Harper	8	"

LOCATION.	DIAM. INCHES.	KIND.
Gratiot ave., 266 ft. w. of Harper to Cadillac	6	iron.
“ 30-inch main in Mullett to w. line of Rivard s.	10	“
“ w. line of Rivard s. to St. Aubin	12	“
Greenwood ave., Bagg to N. Boulevard	6	“
“ crossing Calumet	8	“
Griswold st., Detroit River to Atwater	3	“
“ Atwater to State	6	“
“ s. from 12-inch main in Clifford 60 ft	10	“
Grummond ave., 16-inch main in Woodward to Hamilton Boulevard	6	“
Guilloz st., Clay to Sidney	6	“
Guoin st., e. line of Mullett farm to Orleans	4	“
“ Orleans to McDougall	10	“
“ McDougall to Walker	6	“
Haigh ave., 16-inch main to e. line of Woodward	6	“
“ e. from Woodward 158 ft	4	“
“ Russell to 365 ft. e. of Greeley	6	“
Hale st., Riopelle to St. Aubin	6	“
“ e. from St. Aubin 275 ft	4	“
“ 275 ft. e. of St. Aubin to Dubois	3	“
“ Dubois to Chene	4	“
“ Chene to Grandy	3	“
“ Grandy to Jos. Campau	6	“
Hamilton ave., Mack to 692 ft. n. of Canfield	6	“
Hamilton Boul., crossing N. Boulevard	10	“
“ n. line of N. Boulevard to Blaine	4	“
“ Hazelwood to Bancroft	10	“
Hamlin ave., Woodward to Oakland	4	“
Hammond ave., Toledo to s. line of L. S. R. R	6	“
“ 356 ft. s. of Leavitt to 175 ft. n. of Ranspach	6	“
“ s. from Horatio 956 ft.	6	“
Hancock ave., w. line of Cass to 112 ft. e. of Riopelle	4	“
“ w. from St. Aubin 488 ft	6	“
“ St. Aubin to Dubois	4	“
“ 281 ft. w. of Chene to Grandy	4	“
“ w. line of Mitchell to McDougall	4	“
“ e. from McDougall 281 ft. and crossing Collins	6	“
“ e. line of Collins to Detloff ct	4	“
“ alley w. of Ellery pl. to alley w. of Mt. Elliott	4	“
“ crossing Third	6	“
“ n. side e. from Third 461 ft.	4	“
“ s. side e. from Third 10 ft.	4	“
“ Fourth to Commonwealth	4	“
“ Commonwealth to Avery	6	“
“ Avery to 130 ft. w. of Thirteenth	4	“
“ 130 ft. w. of Thirteenth to w. line of Wabash	6	“
“ w. line of Wabash to Fourteenth	3	“
“ crossing Fourteenth and Seventeenth to Eighteenth	4	“
“ e. from Twenty-third 140 ft	4	“
“ e. line of Twenty-fourth to Twenty-fifth	4	“
“ Twenty-sixth to w. line of Vinewood	4	“
“ crossing W. Boulevard 165 ft	6	“
“ LaSalle to Scotten	4	“
Hanover ave., crossing Russell e. side	4	“
Harmon ave., 16-in. main to e. line of Woodward	6	“
“ e. line of Woodward to Oakland	4	“
Harper ave., Woodward to Russell	4	“

LOCATION.	DIAM. INCHES.	KIND.
Harper ave., Widman pl. to 184 ft. e. of Dubois	4	iron.
“ crossing Dubois and 184 ft. e. of Dubois to w. line of Chene	6	“
“ w. line of Chene to e. line of Mitchell	4	“
“ crossing E. Boulevard and Collins	8	“
“ e. line of Collins to 310 ft. e. of Moran	6	“
“ Baldwin to Van Dyke	6	“
“ Gratiot to Cadillac	6	“
“ w. from Twelfth 176 ft	4	“
“ crossing Fourteenth	6	“
“ w. from Fourteenth 134 ft	4	“
“ 134 ft. w. of Fourteenth to Fifteenth	6	“
Harrison ave., crossing Michigan	12	“
“ Michigan to Grand River	4	“
“ alley w. of, Linden s. to Linden n.	4	“
Harvey ave., Junction to 500 ft. w. of Campbell	4	“
Hastings st., s. line to 16-in. main in Jefferson	16	“
“ Jefferson to Champlain	24	“
“ Congress to Clinton	6	“
“ 118 ft. s. of Congress to Fort and Champlain to Monroe	3	“
“ Clinton to Catherine	4	“
“ crossing Mullett	8	“
“ Catherine to Watson	6	“
“ Watson to Canfield	10	“
“ Canfield to n. line of Warren and crossing Theodore	8	“
“ Farnsworth to Ferry	6	“
“ s. line of Medbury to Harper	8	“
“ Harper to Piquette	6	“
“ Piquette to s. line of Trombly	4	“
“ s. line of Trombly to s. line of N. Boulevard	6	“
“ crossing N. Boulevard	8	“
“ n. line of N. Boulevard to Custer	4	“
“ Custer to 153 ft. n. of Clay	6	“
“ alley w. of, N. Boulevard to Custer	3 & 4	“
Hazel st., Harrison to 156 ft. w. of Twelfth	4	“
“ 156 ft. w. of Twelfth to 96 ft. e. of Thirteenth	3	“
“ e. from Thirteenth 96 ft	4	“
Hazelwood ave., 16-inch main to w. line of Woodward	6	“
“ w. line of Woodward to 13 ft. w. of e. line Hamilton Boulevard	4	“
“ e. from 10-inch main in Hamilton Boulevard 28 ft	6	“
Heck pl., crossing Forest (n. side)	4	“
“ Forest to Hancock	3	“
Hecla ave., Merrick to 343 ft. n. of Kirby	4	“
“ 147 ft. s. to 149 ft. n. of Piquette	6	“
“ s. from Milwaukee 129 ft	6	“
Heidelberg st., crossing Jos. Campau	4	“
“ e. from Jos. Campau 270 ft	2¼	wood.
“ 270 ft. to 445 ft. e. of Jos. Campau ave	3	iron.
“ alley e. of McDougall to w. line of Elmwood	8	“
“ crossing Elmwood, w. side, 39 ft	4	“
“ Elmwood to Mt. Elliott	6	“
Helen ave., Jefferson to Monroe and crossing Mack	6	“
“ Gratiot to 192 ft. n. of Medbury	6	“
Hendricks st., St. Aubin to Dubois	3	“
“ Dubois to alley w. of McDougall	4	“
“ alley e. of, McDougall to Elmwood	4	“

LOCATION.	DIAM. INCHES.	KIND.
Hendricks st., e. from Elmwood 324 ft	6	iron.
" 48 ft. e. of Ellery to 522 ft. w. of Mt. Elliott	6	"
" w. from Mt. Elliott 522 ft	4	"
Hendrie ave., Woodward to 530 ft. e. of John R	4	"
" crossing Brush and St. Aubin	4	"
" e. from Dubois 224 ft	6	"
" 224 ft. e. of Dubois to e. line of Chene	4	"
" e. from e. line of Chene 148 ft	6	"
" 148 ft. e. of Chene to e. line of Grandy	4	"
" Mitchell to e. line of McDougall	6	"
" e. from Baldwin 264 ft	6	"
" 264 ft. e. of Baldwin to Van Dyke	4	"
Henrietta ave., crossing Campbell	6	"
Henry st., Woodward to Clifford	4	"
" Cass to Third	6	"
" Third to alley e. of	4	"
Herbert st., Scotten to 134 ft. w. of Lovett	4	"
Hibbard ave., Jefferson to 202 ft. n. of Brinket	6	"
High st, w. line of Third to Beaubien	4	"
" Beaubien to w. line of A. Beaubien farm	3	"
" w. line of A. Beaubien farm to Russell	4	"
" Russell to Riopelle	3	"
" Grand River to Third	6	"
" w. line of Third to Fourth	3	"
" Fourth to alley w. of Trumbull	4	"
" alley w. of Trumbull to National	3	"
Hoffman st., River st. to Fort	8	"
Holborne ave., e. from Mt. Elliott 170 ft	4	"
Holbrook ave., 16-inch main to e. line of Woodward	6	"
Holcomb ave., Jefferson to Louis	6	"
" Goethe to alley s. of Mack	6	"
" Gratiot to Harper	6	"
Holden ave., Woodward to w. line of Second	6	"
" w. line of Second to Third	3	wood.
" Third to Fourth	4	iron.
" Fourth to Greenwood	3	wood.
" crossing Greenwood	6	iron.
" Greenwood to Commonwealth	4	"
Holden ave., s. from 24-inch main in N. Boulevard 95 ft	10	"
Homer st., w. from Crane 215 ft	4	"
Hooker ave., n. from Grand River 63 ft. and w. from Eighteenth 596 ft.	4	"
" 596 ft. w. of Eighteenth to Sullivan	6	"
Horatio st., Thirty-second to Thirty-third and Howell to Welch	6	"
" Welch to Livernois	4	"
Horton ave., Woodward to Oakland	4	"
Houghton ave., Holcomb to McClellan	4	"
Howard st., Tenth to Twelfth	4	"
" w. side M. C. R R. bridge to Twenty-fourth	6	"
" Twenty-fourth to Twenty-fifth	4	"
" Scotten to alley e. of	4	"
" w. from Junction 343 ft	4	"
" crossing Campbell	6	"
Howell st., alley s. of, to n. line of Buchanan	6	"
" n. from Horatio 680 ft	6	"
Hubbard ave., Fort to 335 ft. n. of Brandon	6	"
" E st. to Michigan ave	4	"

LOCATION.	DIAM. INCHES.	KIND.
Hubbard ave., Michigan to Myrtle	6	iron.
Hudson ave., crossing Fourth, w. side	4	“
“ e. line of, to 564 ft. w. of Greenwood	4	“
“ crossing Fourteenth	6	“
“ crossing Eighteenth, e side	4	“
“ w. from Eighteenth 144 ft	6	“
“ 144 ft. w. of Eighteenth to w. line of Humboldt	4	“
“ Maybury to Twenty-third	4	“
“ w. from Twenty-third 178 ft	6	“
“ 178 ft. w. of Twenty-third to Twenty-fourth	4	“
“ Twenty-sixth to e. line of Vinewood	4	“
Humboldt ave., Michigan to s. line of D. & B. C. R. R	4	“
“ crossing Butternut and Buchanan	6	“
“ s. line Warren to McGraw	6	“
Hunt st., Dubois to alley w. of McDougall	4	“
“ alley e. of McDougall to Elmwood	4	“
“ 15 ft. e. of Ellery to Mt. Elliott	4	“
Hurlbut ave., crossing Jefferson to 21 ft. n. of	6	“
Huron st., s. from Locust 295 ft	3	“
“ Locust to Bagg	6	“
Illinois st., 212 ft w. of Beaubien to Russell	6	“
“ Russell to St. Aubin	4	“
“ St. Aubin to Grandy, w. line	3	“
“ crossing Dubois and Chene	4	“
“ w. line Grandy to Jos. Campau	6	“
“ e. from McDougall 241 ft	3	“
“ 241 ft. e. of to 421 ft. e. of McDougall	4	“
“ w. from Moran 193 ft	4	“
Indiana st., Beaubien to Russell	8	“
Ingersoll st., e. from Wesson 226 ft	4	“
Iron st., Wight to Jefferson	6	“
Irving st., Greenwood to Seventh	4	“
Ivy pl., s. from Grand River 418 ft	6	“
Jackson st., e. line of Scotten to Twenty-ninth	4	“
“ Thirty-fourth to Thirty-fifth	6	“
Jay st., Riopelle to 44 ft. w. of McDougall	4	“
Jefferson ave., Griswold to Orleans	10	“
“ Second to Hastings	16	“
“ Dequindre to w. side of Belt-line R. R	6	“
“ e. side Belt-line R. R. to McClellan	6	“
“ McClellan to e. city limits	10	“
“ e. from e. city limits 741 ft	8	“
“ Meldrum to pumping works	42	“
“ Griswold to First	8	“
“ alley s. of, alley w. of Woodward to alley w. of Griswold	4	“
“ alley s. of, Shelby to Cass	4	“
“ alley s. of, alley w. of Bates to Randolph	4	“
“ alley s. of, Brush to Beaubien	3	“
“ alley s. of, e. from Beaubien 189 ft	4	“
“ alley n. of, Woodward to St. Antoine	4	“
“ alley n. of, alley e. of Griswold to First	4	“
“ alley n. of, Griswold to Shelby and First to Third	8	“
Joe st., Michigan to alley s. of Buchanan	6	“
John R. st., Woodward to Miami	12	“
“ n. s. of Miami to s. side of Madison	4	“
“ n. s. of Madison to Adams	4	“

LOCATION.	DIAM. INCHES.	KIND.
John R st., Columbia to Edmund	8	iron.
" Edmund to Erskine and crossing Eliot and Rowena	6	"
" Brady to Piquette	6	"
" n. from Baltimore 250 ft	3	"
" 250 ft. n. of Baltimore to Milwaukee	6	"
" crossing Canfield and N. Boulevard	8	"
" alley s. of, Custer to Hamlin	6	"
Johnson st., alley w. of Eighteenth to Nineteenth	4	"
Jones st., Cass to 160 ft. w. of Fifth	4	"
" 160 ft. w. of Fifth to Sixth	3	"
Jos. Campau ave., Atwater to Clinton and Jay to s. line of Gratiot	6	"
" s. line Gratiot to St. Joseph	4	"
" St. Joseph to 135 ft. s. of Hancock	6	"
" Theodore to Trombly	6	"
" Trombly to 250 ft. n. of Milwaukee	4	"
" crossing N. Boulevard	8	"
" 250 ft. n. of Milwaukee to 10 ft. n of Denton (on the w.)	6	"
Josephine ave., 16-inch to e. line Woodward	6	"
Joy st., Cass to alley e. of Third	4	"
" Fourth to Fifth	4	"
Junction ave., River st. to Driggs	6	"
" s. line of Wabash R. R. to s. line of Fort	6	"
" s. line of Fort to Otis	8	"
Kanter ave., crossing Collins and E. Boulevard e. side 31 ft	6	"
" 85 ft. w. of Collins to Moran	4	"
" w. from Mt. Elliott 181 ft	4	"
Kercheval ave., Mt. Elliott to Beaufait	4	"
" Field to Baldwin	4	"
King ave., 16-inch main to e. line Woodward	6	"
Kinsman st., Scotten to Twenty-eighth	4	"
Kirby ave., Woodward to w. line of Cass	4	"
" 12 ft. e. of, to 180 ft. w. of Fourth	4	"
" 180 ft. w. of Fourth to Greenwood	3	"
" Greenwood to w. line of Trumbull	4	"
" Commonwealth to Avery	4	"
" Hecla to 195 ft. w. of Twelfth	4	"
" Wabash to Fourteenth	6	"
" w. from Fourteenth 126 ft	4	"
" 126 ft. w. of Fourteenth to 87 ft. e. of Sixteenth	6	"
" 87 ft. e. of Sixteenth to Eighteenth	4	"
" crossing Humboldt and w. from Twenty-seventh 247 ft	4	"
" crossing Brush and e. side of Woodward 46 ft	6	"
" crossing John R. and Grandy	4	"
" e. from Russell 216 ft. and St. Aubin to Chene	4	"
" crossing Collins and e. from Baldwin 161 ft	6	"
" e. from Helen 238 ft	4	"
" e. from Baldwin 161 ft	6	"
" 161 ft. e. of Baldwin to Van Dyke	4	"
Koch. ave., 16-inch main to e. line of Woodward	6	"
" e. line of Woodward to w. line of Oakland	4	"
" crossing Oakland, w. side, 26 ft	6	"
Labrosse st., Fourth to Fifth	4	"
" w. from Tenth 430 ft	3	"
" 430 ft. w. of Tenth to Twelfth	4	"
" alley s. of, Fourth to alley e. of Twelfth	4	"
" alley n. of, alley e. of Fifth to Eighth	4	"
" alley n. of, Eighth to Tenth	3	"

LOCATION.	DIAM. INCHES.	KIND.
Lady's lane, n. from Dry Dock st. 214 ft	4	iron.
Lafayette ave., Griswold to Shelby	4	“
“ w. from Tenth 743 ft	4	“
“ 743 ft. w. of Tenth to M. C. R. R. Bridge	3	“
“ Twelfth to Fourteenth	4	“
“ w. line of Fourteenth to Fifteenth	3	“
“ Fifteenth to Seventeenth	4	“
“ Twenty-second to alley e. of	4	“
“ e. line of Twenty-third to Twenty-fourth	4	“
“ e. from Scotten 256 ft	4	“
“ w. from Junction 315 ft. and e. from Dragoon 123 ft	4	“
“ crossing Campbell and Dragoon to Artillery	6	“
“ alley s. of, Griswold to Shelby and Wayne to First	6	“
“ alley s. of, First to Fourth and Fifth to Tenth	4	“
“ alley n. of, Shelby to First and w. from Tenth 323 ft	4	“
“ alley n. of, First to Tenth	6	“
“ alley n. of, e. from Fourteenth 190 ft	3	“
Lafferty pl , Howard to s. side of M. C. R. R	6	“
Lambie pl., Twenty-first to Twenty-second	6	“
“ crossing Twenty-second and e. side Twenty-third 26 ft	4	“
Lambert st., Concord to Canton	4	“
“ e. from Baldwin 235 ft	6	“
“ 235 ft. e. of Baldwin to Van Dyke	4	“
Langley ave., Fourth to 552 ft. w. of Greenwood	4	“
Lanman st., Twenty-seventh to e. side of Vinewood	6	“
“ crossing Vinewood, e. side	4	“
Lansing ave., Fort to 159 ft. n. of Christiancy	6	“
“ 337 ft. s. of Dix to Toledo	6	“
Larned st., Third to Hastings	16	“
“ Bates to Brush and St. Antoine to Dequindre	4	“
“ Riopelle to St. Aubin	12	“
“ St. Aubin to w. line of Elmwood	4	“
“ w. line of Elmwood to 748 ft. e. of	6	“
“ Leib to Mt. Elliott	4	“
“ w. from Helen 156 ft	4	“
“ Woodward to alley w. of and Third to Fourth	8	“
“ Fourth to Fifth	4	“
LaSalle ave., Michigan to n. line of Buchanan	6	“
“ 359 ft. s. of to 398 ft. n. of Hancock	6	“
“ crossing Warren and s. from McGraw 395 ft	6	“
Lauderdale ave., w. from Junction 272 ft	4	“
“ crossing Campbell	6	“
Laurel st., Grand River to Wabash	4	“
Leach st., w. from Crane 215 ft	4	“
Leavitt ave., Wesson to Livernois	4	“
Ledyard st., Cass to Third	6	“
Leicester ct., 16-in. main to e. line of Woodward	6	“
“ e. from Woodward 1,379 ft	4	“
Leland st., w. from Beaubien 206 ft. and McDougall to Collins	3	“
“ Beaubien to Russell	4	“
“ Russell to McDougall	8	“
“ 216 ft. w. of Moran to Gratiot	4	“
Leroy pl., n. from Forest 251 ft	3	“
Lessing st., e. from McClellan 158 ft	4	“
Leverette st., Seventh to Eighth and Tenth to Twelfth	4	“
“ alley s. of, Eighth to Tenth	4	“

LOCATION.	DIAM. INCHES.	KIND.
, Cass to Fourth	4	iron.
Wight to Jefferson	6	“
Jefferson to Champlain	4	“
Champlain to Monroe	3	“
ave., Grand River to alley n. of	4	“
crossing Calumet n. side 36 ft	8	“
n. line of Calumet to Milwaukee	6	“
crossing N. Boulevard s. side 87 ft	6	“
alley w. of, alley n. of Grand River to s. line of Calumet	4	“
alley w. of, crossing Calumet s. side 16 ft	6	“
t., Harrison to Eighteenth and crossing Humboldt	4	“
alley w. of Humboldt to Maybury	4	“
Tillman to Twenty-fourth	4	“
Twenty-fifth to 26 ft. e. of Twenty-sixth	4	“
s ave., Dix to M. C. R. R.	8	“
M. C. R R. to n. city limits	10	“
t., Grand River to Fourth	6	“
Fourth to alley e. of Trumbull	4	“
alley w. of Trumbull to 30 ft. e. of National	3	“
e. from National 30 ft. and Harrison to Wabash	4	“
low ave., 16-in. main to w. line of Woodward	6	“
ave., Crane to Belvidere	4	“
ave., Woodward to Hamilton Boulevard	6	“
e., Crane to Holcomb	4	“
ve., Michigan to n. line of Buchanan	6	“
n. from Rich 912 ft	4	“
912 ft. n. of Rich to 264 ft. n. of Herbert	6	“
alley w. of, Visger to Jackson	6	“
st., Gratiot to Mt. Elliott	4	“
n cemetery, in the grounds e. from Mt. Elliott 650 ft	3	“
st., Crystal to Orleans	4	“
r st., Fourth to Greenwood and Sixth to Seventh.	3	“
crossing Sixth w. side and Seventh to Lincoln	4	“
Avery to e. line of Thirteenth.	4	“
crossing Thirteenth e. side 21 ft	6	“
r st., w. from Twenty-seventh 340 ft	4	“
n ave., Jefferson to Marietta	6	“
Marietta to Mack	8	“
s. line of Mack to 144 ft. n. of Emmons	10	“
n. from Gratiot 299 feet	8	“
all ave., Atwater to Guoin, and Wight to Clinton	6	“
Guoin to Wight	10	“
Preston to Gratiot and crossing Waterloo, Cleveland and Arndt	8	“
Gratiot to Canfield	4	“
Canfield to 187 ft. n. of Garfield	6	“
187 ft. n. of Garfield to Forest	8	“
Forest to Hancock	6	“
s. from Farnsworth 170 ft	6	“
n. line of Hendrie to Palmer	6	“
alley w. of, Mullett to Jay and Hendricks to Hunt	4	“
alley w. of, Cleveland to Hendricks and Hunt to Charlevoix	3	“
alley w. of, Charlevoix to Heidelberg	4	“
alley e. of, Mullett to 88 ft. n. of Chestnut	4	“
alley e. of, Waterloo to Preston	3	“

LOCATION.	DIAM. INCHES.	KIND.
McDougall ave., alley e. of, crossing Cleveland	4	iron.
" alley e. of, crossing Arndt	6	"
McGraw ave., Sixteenth to Sullivan and 76 ft. e. from Winslow	4	"
" Grand River to Twenty-sixth	4	"
" e. line w. Boulevard to 76 ft. e. of LaSalle	6	"
" 76 ft. e. of LaSalle to Scotten	4	"
McKinstry ave., River st. to n. line of Toledo	6	"
" alley w. of, Plumer to alley s. of	4	"
McMillan st., w. from Junction 319 ft. and crossing Livernois, e. side	4	"
Mack ave., Riopelle to St. Aubin	6	"
" e. from St. Aubin 300 ft. and crossing Dubois and Chene	4	"
" 100 ft. w. of Dubois to Grandy	3	"
" Grandy to Jos. Campau	6	"
" e. from McDougall 402 ft	4	"
" Gratiot to Cadillac	42	"
" Gratiot to Townsend	4	"
" crossing Mt. Elliott and Townsend to Baldwin	6	"
" w. from Helen 80 ft	6	"
" s. side, crossing E. Boulevard 76 ft	6	"
" Beals to 267 ft. e. of Parker	8	"
" 659 ft. w. of, to 577 ft. w. of Fischer	8	"
" 207 ft. w. of, Fischer to 65 ft. e. of Crane s	8	"
" McClellan to Pennsylvania	8	"
" Pennsylvania to e. line of Hamilton	6	"
" e. line of Hamilton to e. line of Park	8	"
" e. line of Park to e. line of Montclair	6	"
Macomb st., St. Antoine to Elmwood	4	"
" alley s. of, from Brush to alley w. of	3	"
" alley s. of, from Brush to St. Antoine	4	"
" alley n. of, from Brush to alley w. of	3	"
" alley n. of, from Brush to St. Antoine	4	"
Madison ave., n. and s. sides from Witherell to John R	4	"
" Randolph to St. Antoine	4	"
" alleys n. and s. of, from John R. to Randolph	4	"
Magnolia st., Harrison to Thirteenth, and Fourteenth to Fifteenth	4	"
" Thirteenth to Wabash, and Eighteenth to Sullivan	3	"
" Sullivan to Maybury, and crossing Humboldt and Twenty-fourth	4	"
" Twenty-seventh to Vinewood	4	"
Mansur st., Harper to 78 ft. s. of Piquette	4	"
Maple st., Gratiot to Orleans and crossing Dubois	8	"
" Orleans to St. Aubin	4	"
" St Aubin to Elmwood	3	"
Marcy st., w. from Fourth 158 ft	3	"
" 158 ft. w. of Fourth to Greenwood	4	"
Marietta st., e. from McClellan 521 ft	4	"
Mark st., w. from Twelfth 180 ft	4	"
Marston ave., 16-inch main to e. line of Woodward	6	"
Martin pl., Woodward to John R	4	"
Maybury ave., Michigan to n. line of Ash	6	"
" n. line of Ash to 34 ft. n. of G. T. Ry	8	"
" 207 ft. s. of to 173 ft. n. of Warren	8	"
" s. from Hudson 256 ft	8	"
Mechanic st., Brush to Beaubien	4	"
Medbury ave., Woodward to 350 ft. e. of John R. and crossing Rivard e. side	4	"

LOCATION.	DIAM. INCHES.	KIND.
dbury park (for Park Comm.), between John R and Rivard (1154 ft.)..	8	iron.
" **ave.**, w. from St. Aubin 730 ft.	3	"
" w. line of St. Aubin to Jos. Campau	4	"
" crossing E. Boulevard and Collins	6	"
" w. from Collins 165 ft	4	"
" 533 ft. w. of to 168 ft. e. of Mt. Elliott	6	"
" Helen to Frontenac	4	"
" Baldwin to VanDyke	6	"
" alley s. of e. from John R. 350 ft. and crossing Brush	4	"
" alley n. of e. from John R 357 ft. and crossing Brush	4	"
elbourne ave., crossing Woodward, e. side	6	"
eldrum ave., Jefferson to Congress	42	"
" Wight to Jefferson	10	"
" Jefferson to 46 ft. n. of Fort	6	"
" 46 ft. of Fort to 360 ft. n. of Kercheval	4	"
" 360 ft. n. of to 642 ft. n. of Kercheval	6	"
" Arndt to Gratiot and crossing N. Boulevard	6	"
errick ave., Cass to Third and w. from Fourth 136 ft	4	"
" 136 ft. w. Fourth to e. line of Greenwood	3	"
" e. line of Greenwood to Lincoln and Trumbull to Twelfth..	4	"
" Twelfth to Wabash	6	"
" w. from Seventeenth 132 ft	4	"
" Tillman to Twenty-third	4	"
" Twenty-seventh to Vinewood	4	"
iami ave., Gratiot to Witherell	16	"
" n. side John R to Witherell	4	"
" alley w. of Gratiot to alley s. of	6	"
" alley w. of Gratiot to Witherell	4	"
" alley e. of Randolph to John R	4	"
higan Stove Works G'nds, Franklin to Woodbridge	4	"
chigan ave., Woodward to Cass	24	"
" Washington to First	10	"
" First to Tenth	8	"
" Foundry to Twenty-fourth	8	"
" Tenth to Vinewood	24	"
" Twenty-fourth to Livernois	6	"
" (s. side) crossing W. Boulevard	6	"
" alley s. of, Shelby to Cass	4	"
" private alley s. of, e. from Shelby 110 ft	3	"
" alley n. of, from alley e. of Griswold to alley e. of Washington	4	"
" alley n. of, from alley w. of Washington to alley w. of Cass	4	"
" alley n. of, from First to alley e. of Second	4	"
" alley n. of, from Second to alley e. of Third	4	"
ilitary ave., River st. to 250 ft. n. of Wabash R. R.	6	"
" 62 ft. n. of Anthon to 157 ft. n. of McMillan	6	"
iller st., Sixth to Seventh	3	"
" crossing Seventh	4	"
ilwaukee ave., Beaubien to Lincoln	6	"
" w. line of Avery to Twelfth and crossing Fourteenth...	6	"
" e. line of Eighteenth to 36 ft. w. of Sullivan	4	"
" Beaubien to w. line of Riopelle	4	"
" w. line of Riopelle to Dubois	6	"
" Dubois to Chene	4	"
" crossing Collins	3	"
iner ave., e. from Crane 336 ft	4	"

LOCATION.	DIAM. INCHES.	KIND.
Minnie ave., River st. to 582 ft. s. of Fort	6	iron.
“ s. from Fort 582 ft.	4	“
Mitchell ave., n. from Gratiot 265 ft.	6	“
“ 265 ft. n. of Gratiot to Canfield	4	“
“ Canfield to Harper	6	“
“ n. from Harper 324 ft	4	“
“ 324 ft. n. of Harper to Trombly	6	“
“ Trombly to Griffin	4	“
“ crossing N. Boulevard s. side	8	“
Mohawk st., crossing Vinewood e. side	4	“
Monroe ave., n. from Cadillac square 51 ft	6	“
“ 51 ft. n. of, Cadillac square to Farmer	4	“
“ Randolph to St. Antoine	8	“
“ St. Antoine to Elmwood	4	“
“ 216 ft. w. of, to 171 ft. e. of Lieb	4	“
“ w. from Helen 185 ft	4	“
“ alley s. of, from alley n. of Cadillac square to Randolph	4	“
“ alley n. of, from alley e. of Woodward to Farmer	4	“
“ alley n. of, from Farmer to alley e. of Farrar	6	“
Montcalm st., w. from Woodward 412 ft	4	“
“ 412 ft. w. of Woodward to Cass	3	“
“ alley e. of Woodward to Brush	4	“
“ Brush to St. Antoine	3	“
“ St. Antoine to Hastings	6	“
“ Hastings to Russell	3	“
“ alley s. of, w. from Beaubien 240 ft	4	“
Montclair ave., n. from Mack 852 ft	6	“
Montieth st., crossing Vinewood e. side and w. from Twenty-seventh 188 ft.	4	“
Moore pl., crossing W. Boulevard	6	“
Moran st., Gratiot to Dane	6	“
Morrell st., River st. to 87 ft. n. of n. line of Christiancy	6	“
“ 348 ft. s. of Dix to Toledo	6	“
Mott ave., 16-inch main to e. line of Woodward	6	“
“ e. from Woodward 558 ft.	4	“
Mt. Elliott ave., 148 ft. s. of Wight to 285 ft. s. of Kercheval	6	“
“ 285 ft. s. of Kercheval to Preston	8	“
“ Preston to Mack	10	“
“ Mack to Gratiot and crossing N. Boulevard	8	“
“ Gratiot to 300 ft. n. of Griffin	4	“
“ 300 ft. n. of Griffin to 14 ft. n. of Strong	6	“
Mt. Elliott Cemetery, in cemetery grounds 1334 ft	4	“
Mullett st., Gratiot to Chene	30	“
“ St. Antoine to Elmwood	4	“
Mulberry st., Twelfth to Thirteenth	4	“
Myrtle st., Grand River to Hubbard	6	“
Nall ave., crossing Vinewood	6	“
Napoleon st., Brush to Russell	4	“
National ave., Michigan to Grand River	6	“
Newark st., Nineteenth to Twentieth	6	“
“ e. from Foundry in Griffin's foundry yard	3	“
Newberry st., w. from Junction 341 ft	4	“
Newton ave., w. from Chene 1,264 ft	4	“
Nineteenth st., Fort to Baker	4	“
“ Baker to Newark	6	“
Noble st., w. from Fourth 150 ft	3	“
“ 150 ft. w. of Fourth to Greenwood	4	“
“ Sixth to Seventh	4	“

LOCATION.	DIAM. INCHES.	KIND.
st., e. from Junction 386 ft	4	iron.
386 ft. e. of Junction to Thirty-first	6	“
e. from Wesson 283 ft	4	“
d ave., Piquette to Trombly	6	“
Milwaukee to s. line of N. Boulevard	4	“
s. line to 24-in. main in N. Boulevard 87 ft	6	“
24-in. main to n. line of N. Boulevard	10	“
Horton to Hamlin	6	“
Hamlin to Clay	10	“
Marston to Koch and crossing Harmon	10	“
Englewood to 130 ft. n. of Woodland	8	“
d st., First to Elton park, e. side	4	“
w. side Elton park to Sixth	4	“
Sixth to Trumbull	6	“
s st., Atwater to Jefferson	10	“
Jefferson to reservoir grounds	8	“
Congress to reservoir grounds	24	“
reservoir to Scott and s. from Canfield 30 ft	30	“
crossing Leland s. side and Alexandrine to Canfield	6	“
n. from Garfield 252 ft	4	“
252 ft. n. of Garfield to 195 ft. n. of Forest	6	“
Trombly to Lyman	4	“
st., e. from Thirteenth 130 ft	3	“
, e. from Junction 300 ft	4	“
300 ft. e. of Junction to alley w. of Thirty-first	6	“
ve., 16-in. main to 1,220 ft. e. of Woodward	6	“
r ave., crossing Woodward w. side	6	“
w. from Hamilton Boulevard 260 ft	6	“
ave., Woodward to w. line of Brush farm	4	“
crossing the same at w. line of Brush farm	4	“
crossing Brush and Collins	6	“
n. and s. sides, crossing Beaubien and St. Antoine	4	“
e. line of St. Aubin to 129 ft. w. of Dubois	6	“
129 ft. w. of Dubois to e. line of Grandy	4	“
crossing Russell and St. Aubin	4	“
e. from Moran 190 ft	4	“
Mt. Elliott to 159 ft. e. of Meldrum	6	“
e. from Baldwin 235 ft	6	“
235 ft. e. of Baldwin to Van Dyke	4	“
ve., Dix to Toledo	6	“
(east of city limits), Mack to 568 ft. n. of Canfield	6	“
l. East, Michigan to s. line of State	4	“
crossing State	6	“
., e. line of Woodward to Columbia	16	“
Henry to Peterboro	4	“
ave., Tonti to 250 ft. n. of Coe	6	“
842 ft. s. of to 534 ft. n. of Mack	6	“
an ave., 16-inch main to w. line of Woodward	6	“
Hamilton Boulevard to 473 ft. w. of Seventh	4	“
s st., Woodward to Cass	4	“
lvania ave., n. from Jefferson 1,419 ft	6	“
Mack to 50 ft. n. of Elsa	6	“
t., Grand River to alley e. of Trumbull	4	“
alley w. of Trumbull to National	4	“
alley s. of, from alley e. of Seventh to alley e. of Trumbull	4	“
Eighteenth to Humboldt	4	“

LOCATION.	DIAM. INCHES.	KIND.
Peterboro st., Woodward to Cass	4	iron.
Philadelphia ave., e. from Russell 389 ft	4	"
Pierce st., Dequindre to Jos. Campau	4	"
Pine st., Grand River to National	4	"
" National to Twelfth	3	"
" crossing Twelfth, e. side	4	"
Pitcher st., Cass to alley e. of Third	4	"
" w. from Fourth 150 ft	3	"
" 150 ft. w. of Fourth to Greenwood and Sixth to Seventh	4	"
Pingree ave., Woodward to Hamilton Boulevard	6	"
Piquette ave., Woodward to Beaubien	4	"
" Beaubien to Russell	6	"
" 466 ft. w. of, to e. line of Chene	4	"
" Chene to Grandy	6	"
" E. Boulevard to Collins	4	"
" crossing E. Boulevard and Collins	6	"
" w. from Moran 182 ft	6	"
" e. from Moran 85 ft	4	"
" w. from Mt. Elliott 326 ft	4	"
" crossing Greenwood, e. side	4	"
" Trumbull to Lincoln	6	"
" w. line of Avery to Twelfth	4	"
" crossing Twelfth and Fourteenth, e. sides	6	"
" Wabash to Fourteenth	4	"
" Eighteenth to Sullivan	4	"
Pleasant ave., n. from River st. 515 ft	4	"
Plum st., Second to alley e. of Trumbull	4	"
" Trumbull to alley e. of	6	"
Plumer st., w. line of McKinstry to 283 ft. w. of Junction	4	"
" 283 ft. w. of Junction to Wesson	6	"
" Welch to Livernois	4	"
" alley s. of, alley w. of McKinstry w. 614 ft	4	"
Pollard st., w. from Jos. Campau 1,242 ft	4	"
Poplar st., 110 ft. e. of Wabash to w. line of Fifteenth	4	"
" crossing Thirteenth, w. side	4	"
" alley w. of Humboldt to 51 ft. w. of Sullivan	6	"
" e. from Maybury 376 ft	4	"
" Tillman to 184 ft. w. of Twenty-third	4	"
Porter st., e. from Twelfth 200 ft	4	"
" w. from Twelfth 210 ft	3	"
" 210 ft. w. of Twelfth to Thirteenth	4	"
" e. from Fourteenth 172 ft	3	"
" crossing Fourteenth and Eighteenth to Nineteenth	4	"
" Twentieth to Twenty-first	3	"
" w. from Twenty-first 150 ft	4	"
" 150 ft. w. of Twenty-first to Twenty-second	3	"
" Twenty-second to e. line of W. Boulevard	4	"
" e. line of W. Boulevard to Vinewood	6	"
" Hubbard to Scotten	3	"
" crossing Hubbard w. side	4	"
" McKinstry to Ferdinand	4	"
" crossing Campbell	6	"
" alley s. of, Thirteenth to alley e. of	3	"
Prentiss ave., Cass to Third	4	"
" alley w. of Fourth to Greenwood	4	"
Preston st., McDougall to Mt. Elliott	4	"

LOCATION.	DIAM. INCHES.	KIND.
st. (n. of Ferry), crossing Rivard e. side	4	iron.
(w. from) Rivard 362 ft.	3	"
way (e. of Russell), s. from Clay 405 ft.	4	"
t ave., Gratiot to Mt. Elliott, and Meldrum to Beaufait	4	"
ave., w. from Woodward 60 ft.	6	"
60 ft. w. of Woodward to w. line of Cass	4	"
n. side, e. from Third 323 ft., and Fourth to Lincoln	4	"
Trumbull to Twelfth	4	"
w. from Twelfth 185 ft.	3	"
185 ft. w. of Twelfth to w. line of Thirteenth	4	"
Wabash to Fourteenth	4	"
y ave., LaSalle to 173 ft. e. of Scotten	6	"
l st., crossing Twenty-third west side, 26 ft	4	"
ph st., alley s. of Atwater to Jefferson	4	"
Atwater to 24-inch main in Cadillac square	8	"
Larned to Congress	4	"
Congress to Adams	6	"
crossing Gratiot	10	"
alley w. of, n. line of Atwater to alley s. of Woodbridge	3	"
alley e. of, from alley s. of Fort to Champlain	4	"
alley e. of, from alley n. of Monroe to Gratiot	4	"
ch st., Hammond to Livernois	4	"
st., Clinton to Gratiot	4	"
l., w. from Fourth 36 ft.	4	"
36 feet w. of Fourth to Greenwood	3	"
w. from Greenwood 335 ft.	4	"
ave., Junction to 438 ft. w. of Campbell	4	"
oir grounds, n. of basin to 30-inch branch	24	"
s. and w. sides of basin	24	"
., e. from Vinewood 204 ft., and Scotten to Twenty-eighth	4	"
le st., Atwater to Jefferson, and Larned to Adelaide	8	"
Jefferson to Larned	12	"
Adelaide to 218 ft. n. of Hancock	6	"
Frederick to Kirby	6	"
alley e. of, Willis to Canfield	4	"
alley e. of, n. from Garfield 233 ft.	4	"
st., Atwater to Jefferson	8	"
Larned to Congress	4	"
Jefferson to Clinton, and Mullett to Gratiot	10	"
Clinton to 9 ft. s. of Mullett	6	"
Gratiot to Watson	4	"
Eliot to 90 ft. s. of Warren	4	"
90 ft. s. of Warren to 10 ft. n of Farnsworth	6	"
10 ft. n. of Farnsworth to 221 ft. n. of Palmer	4	"
221 ft. n. of Palmer to Harper	6	"
crossing Piquette	4	"
5 ft. s. of, to 153 ft. n. of N. Boul	6	"
153 ft. n. of N. Boul. to Clay	4	"
n. from Clay 1178 ft.	6	"
t., Third to Fourth and Fifth to Sixth	4	"
Sixth to e. side of M. C. R. R.	8	"
crossing M. C. R. R. tracks 270 ft.	6	"
w. side of M. C. R. R. tracks to 525 ft. w. of Twenty-fourth	8	"
Pleasant to Campau	8	"
Campau to main entrance of Exposition Grounds	6	"
s. from main into Det. & L. S. Copper Works	4	"

LOCATION.	DIAM. INCHES.	KIND.
Roby st., n. from Ferry 325 ft	4	iron.
Rohns ave., Goethe to alley s. of Mack	6	"
" 360 ft. s. of Chapin to 800 ft. s. of Gratiot	8	"
" 800 ft. s. of Gratiot to s. line of Harper	6	"
Romeyn st., Junction to Campbell	4	"
Rose st., Eighteenth to Twentieth	4	"
Rosedale ave , 16-inch main to e. line of Woodward	6	"
" e. line of Woodward to w. line of Oakland	4	"
Rowena st., Woodward to Riopelle	4	"
Rowland st., s. from State 187 ft	4	"
" n. from State 237 ft.	6	"
Russell st., Larned to n. line of Congress	6	"
" Congress to Macomb and Mullett to Watson	8	"
" Watson to Canfield.	6	"
" Canfield to s. line of Hendrie	10	"
" s. line of Hendrie to s. line of Piquette	8	"
" s. line of Piquette to Alger	6	"
" alley e. of, Chase to Fort	4	"
" alley e. of, n. from Willis 220 ft	4	"
Sargent st., St. Aubin to 6 ft. e. of D., G. H. & M. Ry	6	"
" crossing Collins	6	"
Savoy st., Twenty-first to Twenty-second	4	"
" Twenty-third to Twenty-fourth	4	"
Schiller st., e. from McClellan 245 ft	4	"
Schiller Boulevard, (n. and s. sides), at w. line of Woodward 8 ft	4	"
Schneider pl., e. from Ellery 105 ft	6	"
" 105 ft. e. of Ellery to Mt. Elliott	4	"
Scott st., Orleans to Chene	30	"
" Riopelle to e. line of St. Aubin	4	"
" e. line of St. Aubin to Dubois	3	"
" crossing Dubois to 156 ft. e	4	"
" 156 ft. e. of Dubois to 499 ft. e. of Chene	3	"
" 499 ft. e. of Chene to Jos. Campau	4	"
Scotten ave., Fort to Dix	6	"
" Dix to Buchanan	8	"
" Buchanan s. to Buchanan n	16	"
" Buchanan to McGraw	6	"
" alley e. of Howard to Porter	4	"
Scovel pl., crossing W. Boulevard to 24 ft. e	6	"
" in Mound "Eckstrom" 50 ft	4	"
Sears ave., Holcomb to 193 ft. e. of McClellan	4	"
Second st., Front to Woodbridge	6	"
" Woodbridge to alley n. of Jefferson and crossing Congress	10	"
" Abbott to alley s. of	8	"
" Abbott to Bagg	10	"
Second ave., High to 166 ft. n. of Henry	4	"
" Bagg to 30 ft. n. of Prentiss	6	"
" e. side, s. line of Forest to 184 ft. n. of	6	"
" e. side, crossing Hancock, Warren and Putnam	6	"
" e. side, crossing Merrick, Kirby and Holden	6	"
" w. side, crossing Hancock, Warren and Putnam	4	"
" w. side, crossing Merrick, Kirby and Holden	4	"
" w. side, s. from Holden 700 ft.	3	wood.
" Holden to s. line of N. Boulevard	6	iron.
" crossing Canfield and N. Boulevard	8	"
" st., alley e. of, alley n. of Michigan to Spencer	4	"

LOCATION.	DIAM. INCHES.	KIND.
Second ave., alley e. of, alley n. of Canfield to Prentiss	4	iron.
Selden ave., Woodward to Third and Fourth to alley w. of	4	"
" alley w. of Fourth to Greenwood	3	"
" crossing Greenwood and Sixth to Seventh	4	"
Seventh st., River st. to alley n. of Lafayette	8	"
" alley n. of Lafayette to Bagg	10	"
" Bagg to Grand River and crossing Calumet	8	"
" Grand River to n. line of Merrick	6	"
" 214 ft. s. of Kirby to 684 ft. n. of Stanley	6	"
" alley w. of, alley n. of Pine to Spruce	3	"
" alley w. of, Perry to alley s of	4	"
Seventeenth st., Fort to 28 ft. s. of Poplar	6	"
" 28 ft. s. of Poplar to s. line of Buchanan	4	"
" s. line of Buchanan to Warren	6	"
Seward ave., w. from Woodward 1070 ft	6	"
" 477 ft. e. of, to 184 ft. w. of Hamilton Boulevard	6	"
Seyburn ave., Jefferson to n. line of Agnes	6	"
" s. from Gratiot 462 ft	6	"
Shady lane, crossing W. Boulevard	4	"
" crossing Vinewood	6	"
Shakespeare Boulevard, n. and s. sides at w. line of Woodward ave. 9 ft.	4	"
Shelby st., Atwater to Woodbridge	3	"
" Woodbridge to Jefferson	4	"
" Woodbridge to Jefferson	8	"
" Jefferson to Michigan	10	"
" Lafayette to alley s. of Michigan	4	"
heridan ave., Jefferson to 244 ft. n. of Kercheval	6	"
" Mack to Gratiot	6	"
" Gratiot to 18 ft. n. of Ferry	8	"
herman st., Hastings to Elmwood	4	"
" Russell to Orleans	8	"
Shipherd ave., n. from Champlain 250 ft	6	"
" n. from Florene 169 ft	6	"
Sibley st., Woodward to Clifford	4	"
Sidney ave., 16-inch main in Woodward to w. line of Oakland	6	"
" e. from Russell 779 ft	4	"
Sixth st., River st. to Congress	16	"
" Congress to Abbott	24	"
" River st. to alley n. of	4	"
" alley n. of Labrosse to Cherry	4	"
" Cherry to 47 ft. s. of Bagg	12	"
" s. from 24-inch main in Bagg 94 ft	16	"
" n. from Bagg 88 ft and crossing Calumet	8	"
" n. from Grand River 473 ft	4	"
" 473 ft. n. of Grand River to Calumet	6	"
" Calumet to 265 ft. n. of Lysander	4	"
Sixteenth st., Lafayette to Myrtle	6	"
" Myrtle to Buchanan	8	"
" Buchanan to Grand River	10	"
" Grand River to McGraw	6	"
" s. from 24-inch main in N. Boulevard 63 ft	8	"
" alley w. of, Lafayette to Howard	3	"
Smith ave., Woodward to Oakland	4	"
South st., Grand River to Noble	4	"
Southern ave., e. from Livernois 152 ft	4	"
Spencer st., Cass to Second	4	"

LOCATION.	DIAM. INCHES.	KIND.
Sproat st., Woodward to Cass	4	iron.
Spruce st., Fifth to alley w. of Seventh	4	"
" alley w. of Trumbull to National	4	"
" Harrison to Twelfth	4	"
" Twelfth to Thirteenth	6	"
" alley s. of, alley w. of Seventh to alley e. of Trumbull	3	"
St. Albertus pl., 22 ft. e. of Dequindre to 260 ft. w. of St. Aubin	4	"
" w. from St. Aubin 260 ft	3	"
St. Antoine st., Atwater to Congress and crossing Champlain	8	"
" Jefferson to Congress	4	"
" Congress to n. line of Gratiot	6	"
" Gratiot to Elizabeth	4	"
" Elizabeth to Adelaide	6	"
" Adelaide to Watson and crossing N. Boulevard	8	"
" Watson to Farnsworth and crossing Frederick	6	"
" crossing Palmer	6	"
" s. line of Medbury to s. line of N. Boulevard	6	"
St. Aubin ave., Atwater to s. line of Harper	6	"
" s. line of Harper to Trombly	8	"
" Trombly to n. line of N. Boulevard	10	"
" Clay to 22 ft. n. of Danforth	6	"
" Larned to Congress	12	"
" Congress to Champlain	36	"
" alley e. of, Kirby to Palmer	4	"
" alley w. of, s. from Ferry 266 ft	4	"
St. Clair pl., alley w. of Eighteenth to Nineteenth	4	"
St. Joseph st., Russell to Riopelle	3	"
" e. line of Riopelle to 310 ft. e. of St. Aubin	4	"
" crossing Chene	4	"
" 310 ft. e. of St. Aubin to 202 ft. e. of Chene	3	"
" 202 ft. e. of Chene to Grandy	4	"
" Grandy to Jos. Campau	6	"
" w. line of McDougall to 438 ft. e. of	3 & 4	"
St. Paul ave., Bellevue to e. line of Concord	4	"
" crossing E. Boulevard	6	"
" e. line of E. Boulevard to e. line of Field	4	"
" Townsend to Baldwin and Crane to alley w. of	4	"
Standish st., Twentieth to Foundry	6	"
Stanley ave., w. from Greenwood 365 ft. and crossing Fourteenth	6	"
" Seventh to Commonwealth	4	"
" w. from Twelfth 183 ft. and crossing Eighteenth and Humboldt	4	"
Stanton ave., Merrick to 97 ft. n. of Stanley and crossing N. Boulevard	6	"
Stark ave., Welch to Livernois	4	"
State st., Woodward to Washington	30	"
" Woodward to Cass	10	"
" w. of branch in Washington 24 ft	24	"
Stimson pl., Woodward to Cass	4	"
Sullivan ave., Michigan to Buchanan and crossing Warren	6	"
" 33 ft. n. of Stanley to Baltimore	6	"
" crossing N. Boulevard	8	"
Summit ave., River st. to Wabash R. R. and s. from Fort 300 ft	6	"
Superior st., w. from Beaubien 220 ft. and crossing Brush	4	"
" Beaubien to Russell	6	"
" Riopelle to Dequindre	4	"
" Dequindre to St. Aubin	6	"

LOCATION.	DIAM. INCHES.	KIND.
, crossing e. side St. Aubin and Chene	4	iron.
St. Aubin to 343 ft. e. of Chene	3	"
343 ft. e. of Chene to Mitchell, and McDougall to Gratiot	4	"
40 ft. s. of Wabash R. R. to Fort	6	"
t., w. from Grand River 123 ft.	6	"
alley west of Trumbull to National, and Harrison to Wabash	4	"
w. from Twenty-seventh 105 ft., and e. from Vinewood 65 ft.	4	"
105 ft. w. of Twenty-seventh to 65 ft. e. of Vinewood	6	"
., Gratiot to Mt. Elliott, and Beaufait to Concord	4	"
, crossing Hamilton Boul	6	"
iver st. to Abbott	8	"
bbott to Michigan	24	"
., John R. to 106 ft. e. of Riopelle	4	"
268 ft. w. of St. Aubin to Grandy	4	"
crossing Collins and e. from Helen 191 ft.	6	"
e. from Moran 375 ft.	4	"
Mt. Elliott to w. line of Beaufait	4	"
alley s. of, e. and w. of Davis pl. 150 ft.	4	"
ront to s. line of River st., and Larned to alley n. of.	6	"
line of River st. to Larned	8	"
arned to Fort	24	"
bbott to High	6	"
ley e. of, Front to alley n. of	4	"
ley e. of, alley n. of Michigan to Lewis	4	"
Grand River to Bagg and crossing Calumet	8	"
Bagg to Holden and crossing Baltimore	6	"
Calumet to Canfield	30	"
alley e. of, Henry to Brainard	4	"
st., River st. to Fort	4	"
Fort to Howard	6	"
Porter to Ash and crossing Myrtle	6	"
Magnolia to n. line of Grand River	6	"
n. line of Grand River to 15 ft. n. of Canfield	4	"
15 ft n. of Canfield to Hancock	6	"
n. from Hancock 150 ft.	4	"
150 ft. n. of Hancock to Merrick	6	"
alley e. of, s. from Porter 121 ft.	4	"
, 80 feet s. of Jackson to Buchanan	6	"
Devereaux to 153 ft. s. of Warren	6	"
st., Michigan to 250 ft. s. of Warren, and s. from Norton 105 ft.	6	"
d st., Michigan to 82 ft. n. of Horatio	6	"
st., Michigan to Horatio	6	"
h st., 60 ft. s. of, to 136 ft. n. of Jackson	8	"
64 ft. s. of, to 132 ft. n. of Buchanan	8	"
132 ft. n. of Buchanan to 126 ft. n. of Rich	6	"
st., Michigan to 193 ft. n. of Jackson and crossing Buchanan	6	"
s. of Buchanan 202 ft.	6	"
n. line of Buchanan to 223 ft. n. of Rich	8	"
t., n. of Forest 115 ft.	4	"
., Michigan to Breckenridge	6	"
198 ft. s. of, to 4 ft n. of Warren	6	"
360 ft. s. of, to 300 ft. n. of Merrick (on the w.)	6	"
Hudson to McGraw	6	"
crossing W. Boulevard and Hubbard to 360 ft. e. of Scotten,	6	"

LOCATION.	DIAM. INCHES.	KIND.
Toledo ave., 360 ft. e. of Scotten to McKinstry	4	iron.
" McKinstry to Livernois	6	"
Torrey st., crossing Scotten (w. side), and Lovett to Twenty-eighth	4	"
Townsend ave., Jefferson to 234 ft. n. of Kercheval	6	"
" n. from Mack 208 ft.	6	"
" 208 ft. n. of Mack to s. line of Gratiot	4	"
" s. line to 8-inch main in Gratiot	8	"
" 8-inch main in Gratiot to 65 ft. n. of Palmer	6	"
Trombly st., Oakland to Hastings	6	"
" Crystal to Russell	4	"
" Russell to e. line of St. Aubin	8	"
" w. from Chene 183 ft	6	"
" Chene to 72 ft. e. of Ellery	4	"
" 72. ft. e. of Ellery to Mt. Elliott and crossing Collins	6	"
Trowbridge ave., 16-inch main to e. line of Woodward	6	"
" e. from Woodward 511 ft	4	"
Trumbull ave., Abbott to alley s. of	10	"
" n. from Abbott 30 ft., and Michigan to Plum	6	"
" Grand River to alley n. of	6	"
" Calumet to Forest	8	"
" Forest to 497 ft. n. of G. T. Ry	6	"
" 497 ft. n. of G. T. Ry. to 50 ft. n. of Piquette	8	"
" 50. ft. n. of Piquette to Holden	6	"
" alley e. of, Plum to Sycamore	6	"
" alley w. of, Cherry to Pine	3	"
" alley w. of, Pine to Myrtle	4	"
" alley w. of, alley n. of Grand River to Calumet	6	"
Tuscola st., Third to Fourth	6	"
" alleys n. and s. of, alley w. of Fourth to Greenwood	4	"
Twelfth st., 458 ft. s. of River st. to Lafayette	4	"
" Howard to Baker	4	"
" Baker to Calumet	6	"
" Calumet to s. line of N Boulevard	8	"
" s. line of, to 16 ft. s. of n. line of N. Boulevard	10	"
" 200 ft. e. of, Porter to alley n. of	4	"
Twentieth st., Fort to Michigan	6	"
" alley e. of, s. from Rose 197 ft	3	"
Twenty-first st., Fort to Standish	4	"
Twenty-second st., Fort to Dalzelle	6	"
" alley e. of, Brevoort to Webster	4	"
Twenty-third st., Fort to Magnolia	6	"
" Magnolia to 35 ft. n. of Linden	3	"
" 35 ft. n. of Linden to 100 ft. n. of Poplar	4	"
" 100 ft. n. of Poplar to Kirby and crossing McGraw	6	"
" Kirby to s. line of McGraw	4	"
Twenty-fourth st., River st., to Fort	4	"
" Fort to Baker	6	"
" Baker to s. line of Michigan	8	"
" s. line of, to 96 ft. n. of Michigan	16	"
" 96 ft. n. of, to 181 ft. n. of Michigan	18	"
" 181 ft. n. of, to 236 ft. n. of Michigan	20	"
" 236 ft. n. of Michigan to Butternut	24	"
" Butternut to Buchanan	10	"
" Buchanan to n. line of McGraw	8	"
" n. line of McGraw to Chope pl	6	"
Twenty-fifth st., Howard to Baker	4	"

LOCATION.	DIAM. INCHES.	KIND.
Twenty-fifth st., Baker to 65 ft. s. of Toledo	6	iron.
" E st. to Michigan	4	"
" Michigan to Linden	6	"
" n. from Linden 192 ft	3	"
" 595 ft. s. of Buchanan to Hancock	6	"
" crossing Warren and 69 ft. s. of Hudson to n. line of McGraw	6	"
Twenty-sixth st., 213 ft. s. of E st. to 146 ft. s. of Hancock	6	"
" 146 ft. s. of to 421 ft. n. of Hancock	8	"
" 421 ft. n. of Hancock to McGraw	6	"
Twenty-seventh st., Myrtle to McGraw	6	"
" crossing Buchanan	8	"
Twenty-eighth st., Michigan to 14 ft. n. of Rich	6	"
Twenty-ninth st., 565 ft. s. of Michigan to Buchanan	6	"
Union st., Fourth to Fifth	3	"
" crossing Fifth (e. side)	4	"
Uthes st., Clark to McKinstry	4	"
Van Dyke ave., Jefferson to 150 ft. n. of Waterloo and Mack to n. line of Gratiot	8	"
" Jefferson connecting with 42-inch main 22 ft	10	"
" s. from Mack 1320 ft. and Gratiot to Harper	6	"
Vine st., Fourth to Fifth	3	"
" crossing Fifth (e. side)	4	"
Vinewood ave., Fort to Buchanan	24	"
" Fort to 430 ft. n. of Toledo and F st. to Buchanan	6	"
" Buchanan to Merrick	10	"
" s. from Grand River 300 ft	8	"
Virginia ave., 16-inch main to 5 ft. e. of w. line of Woodward	6	"
" (n. and s. sides), w. line of Woodward to Hamilton Boul.	4	"
Visger st., Vinewood to La Salle and crossing Scotten e. side	6	"
" Lovett to Twenty-eighth	6	"
Wabash ave., crossing Grand River and N. Boulevard	6	"
" n. line of M. C. R. R. to Ottawa	6	"
" Ottawa to s. line of Buchanan	4	"
" s. line of Buchanan to s. line of L. S. R. R	8	"
" s. line of L. S. R. R. to 186 ft. n. of Piquette	6	"
" alley e. of, Bagg to Myrtle	6	"
Walbridge st., w. from Van Dyke 221 ft	6	"
Walker st., Atwater to Jefferson	4	"
Walnut st., w. from Van Dyke 264 ft	6	"
Warren ave., Woodward to Cass and Second to Third	4	"
" Third to Greenwood	6	"
" Greenwood to 106 ft. w. of Seventh	4	"
" e. from Trumbull 107 ft	6	"
" Avery to alley w. of Wabash	4	"
" Fourteenth to Sixteenth	4	"
" Grand River to w. line of Scotten	6	"
" Woodward to 105 ft. e. of Riopelle	4	"
" Moran to Detloff ct. and crossing Collins	6	"
" Warren ct. to Grandy and e. from Helen 228 ft	4	"
Warren ct., 181 ft. s. of to 56 ft. n. of Warren ave	4	"
Warsaw pl., 17 ft. e. of Dequindre to St. Aubin	6	"
Washington ave., Michigan to State	30	"
" Michigan to Park	10	"
" alleys e. and w. of, alley n. of Michigan to alley s. of Park	4	"

LOCATION.	DIAM. INCHES.	KIND.
Waterloo st., Dequindre to Jos. Campau	4	iron.
“ Jos. Campau to Burlage pl	6	“
“ Burlage to Mt. Elliott	8	“
“ Mt. Elliott to 57 ft. e. of Beaufait	4	“
Watson st., Woodward to Brush	4	“
“ Brush to Reservoir	24	“
“ Dequindre to Chene	4	“
Wayne st., s. from Woodbridge 173 ft	4	“
“ Woodbridge to Michigan	6	“
Webster pl., alley w. of Eighteenth to Nineteenth	4	“
“ Twenty-second to alley e. of	6	“
Webb ave., 16-inch main to w. line of Woodward	6	“
“ w. line of Woodward to Hamilton Boul., e. line	4	“
Welch ave., Plumer to s. line of M. C. R. R.	6	“
“ 211 ft. s. of, to 309 ft. n. of Stark	6	“
“ s. line of Ingersoll to n. city limits	6	“
Wesson ave., Toledo to 84 ft. n. of Dunn	6	“
“ n. line of G. T. Ry. to Leavitt	6	“
“ D., L. & N. Ry. to 190 ft. n. of Herbert	6	“
Western Hay Market, w. from Trumbull 171 ft	3	“
Westminster ave., 16-inch to 1,222 ft. e. of Woodward	6	“
Whipple st., Baldwin to Van Dyke	4	“
Whiting ave., e. from Jos. Campau 1,880 ft	4	“
Widman pl., Harper to 55 ft. n. of Piquette	6	“
Wight st., Chene to McDougall	4	“
“ McDougall to Mt. Elliott	10	“
“ Mt. Elliott to 110 ft. e. of Meldrum	6	“
“ alley s. of, e. from McDougall 230 ft	4	“
Wilcox st., Woodward to Miami	12	“
Wilkins st., Brush to Russell	4	“
“ 158 ft. w. of Riopelle to Orleans	4	“
“ Orleans to 30-inch main in Chene	8	“
Willard st., e. from Van Dyke 255 ft	4	“
Williams ave., Michigan to 196 ft. n. of Breckenridge	6	“
“ crossing Warren, and n. line of Merrick to Hudson	6	“
Willis ave., Woodward to Beaubien, and e. from Hastings 356 ft	4	“
“ Beaubien to St. Antoine, and 356 ft. e. of Hastings to Rivard	3	“
“ St. Antoine to Hastings	6	“
“ Rivard to Russell	6	“
“ Russell to e. line of Chene	4	“
“ e. line of Chene to Grandy	3	“
“ Jos. Campau to Collins	6	“
“ e. from Collins 146 ft., and Moran to alley w. of Mt. Elliott	4	“
“ Woodward to Fourth	6	“
“ Fourth to Greenwood, and Sixth to Eighth	4	“
“ e. from Twelfth 215 ft	6	“
“ crossing Twelfth, e. side	4	“
Winder st., Woodward to Orleans	4	“
Wing pl., alley w. of Eighteenth to Nineteenth	4	“
Winslow ave., n. from Grand River 85 ft	4	“
“ 85 ft. n. of Grand River to McGraw	6	“
Winter st., e. from Dequindre 431 ft	4	“
Witherell st., e. line of Woodward to Miami	16	“
“ Woodward to Miami	6	“
“ Miami to Adams	4	“
“ Adams to alley n. of	3	“

LOCATION.	DIAM. INCHES.	KIND.
Wolff st., e. from Scotten 357 ft	4	iron.
Woodbridge st., Randolph to Brush and St. Antoine to Rivard	4	"
" w. from St. Antoine 230 ft. and Rivard to Russell	3	"
" Russell to Orleans and e. from Jos. Campau 400 ft	4	"
" Orleans to Dubois and w. from Jos. Campau 300 ft.	6	"
" 400 ft. e. of Joseph Campau to McDougall	6	"
" w. from Leib 325 ft	4	"
" crossing Woodward	8	"
" Woodward to Griswold and First to Second	6	"
" Griswold to First	4	"
" alley s. of, Bates to Randolph	4	"
" alley s. of, Brush to 210 ft. e. of Beaubien	3	"
Woodland ave., 16-inch main to e. line of Woodward	6	"
" e. from Woodward 780 ft	4	"
Woodward ave., Atwater to Jefferson and N. Boulevard to Woodland	16	"
" (e. side), s. from Atwater 246 ft	3	"
" (e. side), s. from N. Boulevard 102 ft	4	"
" (w. side), s. from Atwater 171 ft	4	"
" Jefferson to Soldiers' Monument and Bagg to Edmund	24	"
" Atwater to Adams and Baltimore to Clay	8	"
" Adams to Baltimore	10	"
" High to 200 ft. n. of Canfield	4	"
" Woodland to 15 ft. n. of city limits	12	"
" (w. side), crossing Virginia	6	"
" (w. side), crossing Shakespeare Boulevard	6	"
" (w. side), crossing Schiller Boulevard	6	"
" (e. side), crossing Melbourne on the s. side	6	"
" (e. side), crossing Chicago Boulevard	6	"
" (e. side), crossing Boston Boulevard	6	"
" alley e. of, alley s. of Atwater to alley s. of Jefferson	4	"
" alley e. of, alley n. of Jefferson to alley n. of Congress.	4	"
" alley e. of, Gratiot to alley s. of	6	"
" alley e. of, n. from Gratiot 130 ft	8	"
" alley e. of, 130 ft. n. of Gratiot to alley s. of Witherell.	4	"
" alley e. of, Elizabeth to alley s. of	3	"
" alley e. of, crossing Elizabeth, s. side	4	"
" alley e. of, Elizabeth to Columbia	6	"
" alley e. of, Columbia to Montcalm	4	"
" alley w. of, Atwater to alley s. of Jefferson	4	"
" alley w. of, alley n. of Jefferson to Larned	4	"
" alley w. of, Larned to Congress	8	"
" alley w. of, Congress to alley n. of	4	"
" alley w. of, alley n. of Michigan to alley s. of Park	4	"
" alley w. of, Montcalm to High	3	"
Woodward ave. terrace, Woodward to w. line of John R	4	"
Wreford pl., Eighteenth to Grand River	4	"
" crossing w. Boulevard	6	"
Zender pl., e. from Ellery 288 ft	6	"
" 288 ft. e. of Ellery to Mt. Elliott	4	'

SUPPLEMENT.

BOARD OF MANAGEMENT OF DETROIT WATER WORKS.

Board of Trustees appointed by Common Council, February 24th, 1852; organized March 1st, 1852:

Shubael Conant, Chairman.
Henry Ledyard.
Edmund A. Brush.
Jas. A. Van Dyke.
Wm. R. Noyes.

1853.

On the 16th of May, 1853, the Board of Water Commissioners of the City of Detroit was organized under an act previously approved by the Common Council and passed by the Legislature, February 14th, 1853. The term of service was determined by lot, as follows:

Jas. A. Van Dyke,	for 3 years.
Edmund A. Brush,	for 4 years.
Henry Ledyard,	for 5 years.
Shubael Conant,	for 6 years.
Wm. R. Noyes,	for 7 years.

Shubael Conant was elected President, who, finding the duties too arduous, resigned July 30th, and Edmund A. Brush was elected.

1854.

Edmund A. Brush, President.
Shubael Conant.
Jas. A. Van Dyke.
Wm. R. Noyes.
Henry Ledyard.

1855.

Edmund A. Brush, President.
Henry Ledyard.
Shubael Conant.
Wm. R. Noyes.
Jas. A. Van Dyke, died May 8th.
A. D. Fraser, appointed to fill vacancy.

1856.

Edmund A. Brush, President.
Shubael Conant.
Wm. R. Noyes.
Alexander D. Fraser, re-appointed May 1st for 5 years.
Henry Ledyard.

1857.

Edmund A. Brush, President, re-appointed May 1st for 5 years.
Henry Ledyard.
Alexander D. Fraser.
Wm. R. Noyes.
Shubael Conant.

1858.

Edmund A. Brush, President.
Shubael Conant.
Alexander D. Fraser.
Henry Ledyard, re-appointed May 1st for 5 years.
Wm. R. Noyes.

1859.

Edmund A. Brush, President.
Alexander D. Fraser.
Wm. R. Noyes.
Shubael Conant, term expired May 1st, and
Julius D. Morton, appointed for 5 years.
Henry Ledyard, vacated by removal from city, and
Jno. V. Ruehle, appointed May 1st to fill vacancy.

1860.

Edmund A. Brush, President.
Alexander D. Fraser.
Julius D. Morton.
Wm. R. Noyes, re-appointed May 1st for 5 years.
Jno. V. Ruehle.

1861.

dmund A. Brush, President.
lexander D. Fraser, re-appointed May 1st for 5 years.
Jno. V. Ruehle, resigned Sept. 16th, and
Chauncey Hurlbut, appointed to fill vacancy.

1862.

Edmund A. Brush, President, re-appointed May 1st for 5 years.
Wm. R. Noyes.
Julius D. Morton.
Chauncey Hurlbut.
Alexander D. Fraser.

1863.

Edmund A. Brush, President.
Alexander D. Fraser.
Wm. R. Noyes.
Julius D. Morton.
Chauncey Hurlbut, term expired May 1st, and
Stanley G. Wight appointed for 5 years.

1864.

Edmund A. Brush, President.
Alexander D. Fraser.
Wm. R. Noyes.
Julius D. Morton, term expired May 1st.
Stanley G. Wight.

1865.

Edmund A. Brush, President.
Wm. R. Noyes, resigned Jan. 10, and Jacob S. Farrand appointed to fill vacancy. Term expired May 1st. Re-appointed for 5 years.
Alexander D. Fraser.
Stanley G. Wight.
Julius D. Morton, re-appointed for 5 years from May 1st, 1864. Died Feb. 14, 1865, and
Jno. Owen appointed to fill vacancy.

1866.

Edmund A. Brush, President.
Alexander D. Fraser, re-appointed May 1 for 5 years.
Stanley G. Wight.
Jacob S. Farrand.
Jno. Owen.

1867.

Edmund A. Brush, President, re-appointed May 1 for 5 yrs.
Alexander D. Fraser.
Jacob S. Farrand.
Jno. Owen.
Stanley G. Wight.

1868.

*Edmund A. Brush, President.
Stanley G. Wight, term expired May 1, and
Chauncey Hurlbut appointed for 5 years.
Jacob S. Farrand.
John Owen.
Caleb Van Husan.

*Edmund A. Brush resigned January 28, and Caleb Van Husan appointed to fill vacancy, and Alexander D. Fraser elected President.

1869.

Alexander D. Fraser, President.
Jno. Owen, re-appointed May 1, for 5 years.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.

1870.

Alexander D. Fraser, President.
Jacob S. Farrand, re-appointed May 1, for 5 years.
Jno. Owen.
Caleb Van Husan.
Chauncey Hurlbut.

1871.

*Alexander D. Fraser, President.
Jacob S. Farrand.
Caleb Van Husan.
Chauncey Hurlbut.
John Owen.

*Term expired May 1, and Samuel F. Hodge appointed for 5 years. Jacob S. Farrand elected President.

1872.

Farrand, President. *Caleb Van Husan.
n. Samuel F. Hodge.
Chauncey Hurlbut.

pired May 1st, and Elija Smith appointed for 5 years.

1873.

y Hurlbut, President. Jacob S. Farrand.
n. Samuel F. Hodge.
Elija Smith.

rm expired and re-appointed. Elected President May, 1872.

1874.

Hurlbut, President. Jacob S. Farrand.
en, Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1875.

Hurlbut, President. *Jacob S. Farrand.
n. Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1876.

Hurlbut, President. Jacob S. Farrand.
n. *Samuel F. Hodge.
Elija Smith.

*Term expired and re-appointed.

1877.

Hurlbut, President. Jacob S. Farrand.
n. Samuel F. Hodge.
*Michael Martz.

Smith's term expired and Michael Martz appointed to fill vacancy.

1878.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Jno. Owen. Samuel F. Hodge.
Michael Martz.

*Term expired and re-appointed.

1879.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
*Jno. Pridgeon.

*Jno. Owen's term expired and Jno. Pridgeon appointed to fill vacancy. Samuel F. Hodge resigned and Jas. Beatty appointed to fill vacancy.

1880.

Chauncey Hurlbut, President. *Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1881.

Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. *Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1882.

Chauncey Hurlbut, President. Jacob S. Farrand.
*Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1883.

*Chauncey Hurlbut, President. Jacob S. Farrand.
Michael Martz. Jas. Beatty.
Jno. Pridgeon.

*Term expired and re-appointed.

1884.

y Hurlbut, President. Jacob S. Farrand.
Martz. Jas. Beatty.
*Jno. Pridgeon.

* Term expired; Marshall H. Godfrey appointed.

1885.

S. Farrand, President. Michael Martz.
l H. Godfrey. *Edwin F. Conely.
*Samuel G. Caskey.

. Beatty died and Edwin F. Conely appointed to fill vacancy.
ancey Hurlbut died and Samuel G. Caskey appointed to fill vacancy.
ob S. Farrand's term expired and re-appointed.

1886.

Farrand, President. Michael Martz.
l H. Godfrey. *Jno. Pridgeon.
Samuel G. Caskey.

F. Conely's term expired and Jno. Pridgeon appointed to fill vacancy.

1887.

Farrand, President. Jno. Pridgeon.
l H. Godfrey. Samuel G. Caskey.
*Joseph Nagel.

ael Martz's term expired and Joseph Nagel appointed to fill vacancy.

1888.

Farrand, President. Jno. Pridgeon.
H. Godfrey. *Samuel G. Caskey.
Joseph Nagel.

* Term expired and re-appointed.

1889.

Farrand, President. Jno. Pridgeon.
G. Caskey. Jos. Nagel.
*August Goebel.

all H. Godfrey resigned Jan. 1, 1889. August Goebel appointed to fill
erm expired May 1st, and re-appointed.

1890.

Jno. Pridgeon, President. Samuel G. Caskey.
Joseph Nagel. August Goebel.
*Henry M. Duffield.

* Jacob S. Farrand's term expired, and Col. Duffield was appointed to fill vacancy. July 9th, 1890, Jno. Pridgeon resigned as President of the Board, on account of ill-health, and Henry M. Duffield was elected to fill vacancy.

1891.

Henry M. Duffield, President. *Jno. Pridgeon.
August Goebel. Samuel G. Caskey.
Joseph L. Hudson.

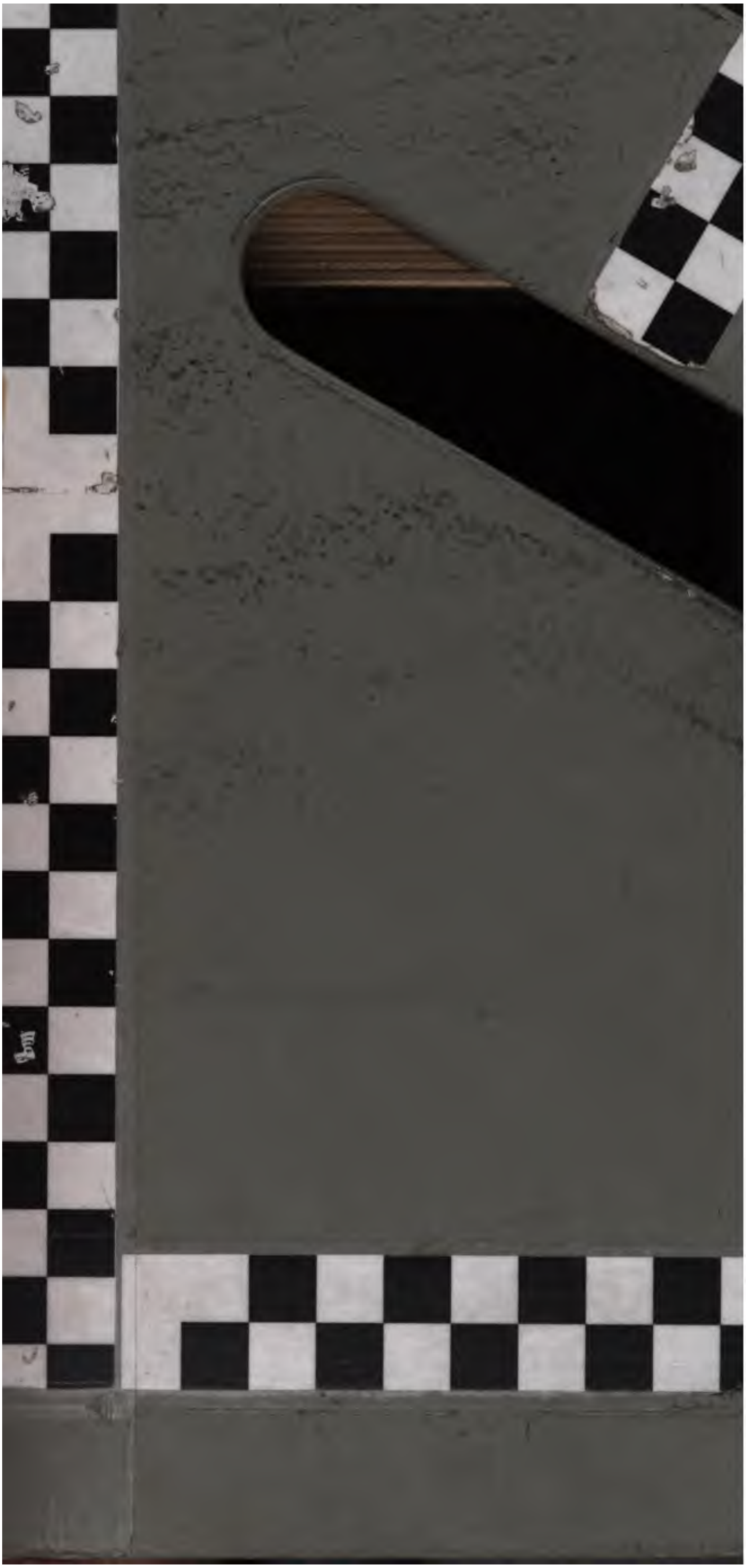
* Jno. Pridgeon's term expired May 1st, and Frank E. Kirby was appointed for a term of 5 years.

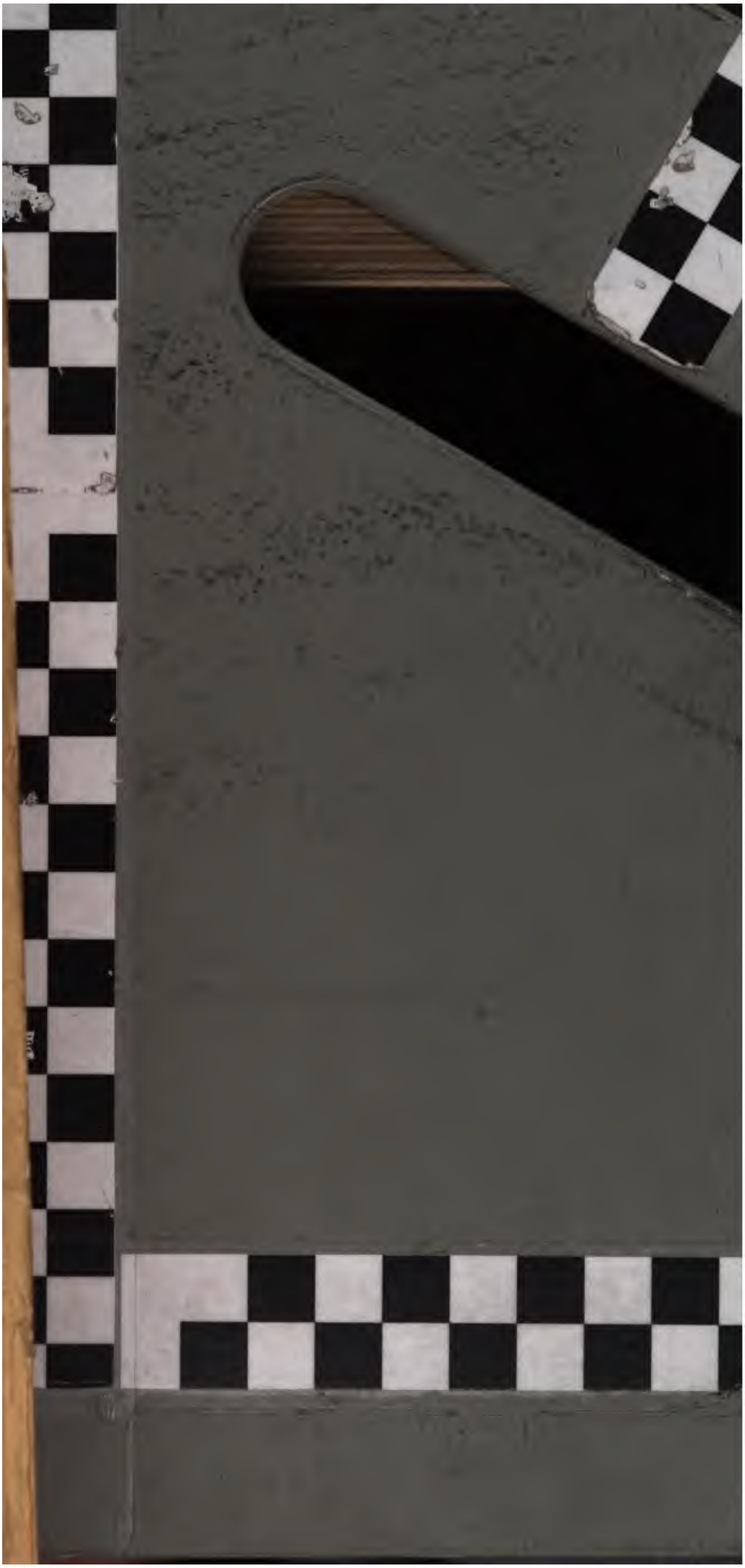
1892.

Samuel G. Caskey, President. Henry M. Duffield.
August Goebel. Joseph L. Hudson.
Frank E. Kirby.

1893.

August Goebel, President. Samuel G. Caskey.
Frank E. Kirby. Henry M. Duffield.
Joseph L. Hudson.





FORTY-FIRST
ANNUAL REPORT
OF THE
BOARD OF WATER COMMISSIONERS

NEW WATER WORKS.

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR

1892.

Calvert Lith. Co. Detroit, Mich.

FORTY-FIRST ANNUAL REPORT

OF THE

Board of Water Commissioners

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1892.

DETROIT:
THE DETROIT FREE PRESS PRINTING COMPANY.
1893.

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BOARD OF WATER COMMISSIONERS.

DETROIT, 1892.

MEMBERS:

JOSEPH L. HUDSON, 1892.
AUGUST GOEBEL, 1894.
SAMUEL G. CASKEY, 1893.
HENRY M. DUFFIELD, 1895.
FRANK E. KIRBY, 1896.

COMMITTEES:

Ways and Means	Commissioners DUFFIELD, HUDSON.
Extension and Construction	Commissioners HUDSON, KIRBY.
Pumping Works	Commissioners KIRBY, GOEBEL.
Supplies	Commissioners GOEBEL, DUFFIELD.

OFFICERS:

President	SAMUEL G. CASKEY.
Vice-President	AUGUST GOEBEL.
Secretary	L. N. CASE.
Supt. of Extension and Construction	HENRY BRIDGE.
Supt. of Meters and Inspection	THOMAS R. PUTNAM.
Supt. of Grounds	E. A. SCRIBNER.
Chief Engineer, Acting	URIAH GOULD.
" " Consulting	JOHN E. EDWARDS.
Meter Clerk	HARRY S. STARKEY.
Assessors and Collectors	MAX F. GREUNER. ALBERT W. GOODSELL. ANTHONY T. McLOGAN. FRED. H. HUTAFF. HARRY L. JAMES. AUGUST GOEBEL, Jr. JOHN ROBINSON. PETER BECKER.
Receiving Clerk	GEORGE E. KUNZE.
Permit Clerk	AUGUST KUENZEL.

DETROIT WATER WORKS.

METER RATES.

First 3,000 Cubic feet, each month, each 100 gallons	**⅔ of a cent.**
All over, each 100 gallons	**⅓ of a cent.**

ASSESSMENT RATES.

FROM JULY 1st, 1886.

		PER ANNUM
For Family, household purposes		$5 00
Green Houses.—Special rates.		
Private Stables, for each horse		2 00
Livery Stables, “ “ “		2 00
Dray and Team Horses, each		1 00
Cows, each		1 00
Stores and Offices,	$2 00 to	20 00
Bakeries, average daily use, for each barrel of flour		3 50
Saloons, Groceries and Provision Stores, from	$3 00 to	100 00
Bar, with faucet, from	8 00 to	50 00
Fish Houses	10 00 to	100 00
Slaughter Houses.—Special rates.		
Hotels and Taverns, in addition to family rate, each room		1 00
Boarding Schools, each room		1 00
Public Schools, from	$5 00 to	50 00
Building Purposes, each 1 M brick		5
“ “ “ 100 yards plastering		10
“ “ “ perch stone		1½
Printing Offices.—Special rates.		
Butcher Stalls, each not less than		3 00
Workshops, for 10 persons or under		3 00
“ for each additional 10 persons		1 00
Estimated quantities of water each 100 gallons		2
Boarding Houses, in additional to family rate, each boarder		1 00

FIXTURES.

Bath Tubs, for families, 1st tub, $2; each additional		$1 00
Bath Tubs, public, each tub		5 00
Water-closets, for a family, 1st closet, $3 00; each additional, $2 00	$3 00 to	15 00
Water-closets, for Hotels, Stores, Factories, etc., for 10 persons, $5 00; each additional person		25
Rod Water-closets, not less than		6 00
Urinals, not less than		2 00
Wash-Hand Basins, for family	$1 00 to	3 00
“ “ “ for other purposes, each person		25
Permanent Wash Tubs		2 00
Hose, for lawn and street sprinkling purposes		*free.*
Hose, for other purposes	$3 00 to	30 00
Fountains	5 00 to	20 00
Street Sprinklers, each wagon		150 00

Where there is a waste of water a proper increase of rates will be made.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

WATER COMMISSIONERS' OFFICE.

DETROIT, January —, 1893.

To the Common Council of the City of Detroit:

The Board of Water Commissioners respectfully submits its annual report for the year ending December 31, 1892.

Accompanying this report to your honorable body, are the reports of the Secretary, upon the general management and financial transactions of the Board, and of the several heads of departments, to which your careful attention is respectfully invited.

Our fellow-citizens will be pleased to learn that the long and vexatious litigations growing out of the Hurlbut will, have at last come to a conclusion. The Board will soon be in the position to improve considerably the Water Works park, as it will be remembered that the income from this entire legacy is to be used to beautify the said grounds and for no other purpose.

On the first day of August next, water bonds to the amount of $146,000 will become due and payable. There will be in the sinking fund at that time something over $75,000. It will be necessary, therefore, to make up the difference of $71,000, either from the general fund or by the issuance of new bonds. The Secretary has estimated that at that time there will be in the general fund, at least $75,000, which we believe to be correct, and it is the unanimous opinion of the members of this Board that the interests of the city affected, would be best conserved by the payment of this balance from this fund.

The building of an additional engine and the necessary construction for its operation have already commenced, and will be completed by the first of July. It will be seen by the Engineer's report, that it was not increased consumption that required this construction, as the quantity pumped in 1892 was considerably less than that of 1887, five years ago.

The unusual and unexpected demand for water during the protracted heat and drouth of July and August practically exhausted the pumping capacity of the Works, and forced this step upon the attention of the Board. The possibility of its recurrence made it necessary to provide for such a contingency, and for this reason only is the new engine being purchased.

We feel that we have reason to congratulate ourselves upon the condition of the Works at this time, and upon the changes or innovations introduced in its operation. The establishment of an oil plant by which there is an annual saving of over $12,000 in the cost of fuel could not have happened more opportunely, as the condition of the natural gas supply would have forced us months ago to resort again to the use of coal, which at the present prices would have made our expense for pumping water over $18,000 more than it now costs with oil.

The thorough efficiency of the Works, and an economical administration of its affairs, we have aimed to accomplish. And when we consider that the operating expenses of 1892 were $2,000 less than those of 1888, notwithstanding that the population has increased 50,000, with all the accompanying mechanical and industrial pursuits that have been established during this time, we certainly feel a just pride in the results which the introduction of remedial measures have produced.

The efficiency of the Works has also been improved in various particulars, especially that of equalizing the head of water throughout the city to such an extent as to cause complaints of a short or insufficient supply to almost entirely cease.

We are also gratified to state that under arrangements ntered into with the Board of Public Works at the beginning f the year, harmony has prevailed in our relationship with that Board, and we desire to add further that, with all the other departments of our municipal government, the conduct of mutual affairs has been most pleasant and influenced simply to the accomplishment of the public good.

All of which is respectfully submitted.

SAMUEL G. CASKEY,
AUGUST GOEBEL,
HENRY M. DUFFIELD,
J. L. HUDSON,
FRANK E. KIRBY,
Commissioners.

REPORT OF THE SECRETARY.

DETROIT, January 2d, 1893.

To the Board of Water Commissioners:

GENTLEMEN,—I have the honor to present herewith my report of the general transactions and operations of the Works for the past year, together with a detailed statement of the financial affairs of the Board.

Probably the most important operation of the Board has been, for the last four years, and is to-day, its determined efforts to

REDUCE THE WASTE OF WATER.

It is an established fact the world over, that the consumption of water increases much more rapidly than the population, where no means are in use to keep a record individually of such consumption.

Various reasons, other than the true one, are often given for this increased consumption. A certain portion of this increase is often ascribed to the growth of the manufacturing and business interests of a community; but when it is considered that if a certain business interest will provide support for ten families and that the establishment of a similar interest will provide for ten additional families, it seems to be a fact that the *pro rata* of families in their relationship to business must necessarily remain the same, and that some other cause must be sought for.

In establishing and illustrating certain facts, I am obliged to have recourse to tabular statements, and although figures must necessarily be dry and uninteresting, yet I earnestly invite careful attention to the tables herewith introduced.

To illustrate the rapid growth in the consumption of water from year to year, I have prepared the following table, showing e number of families supplied, the total quantity of water umped, and the *pro rata* quantity for each family in each year during the entire time that the Works have been under a Commission and a record kept :

YEARS.	FAMILIES SUPPLIED.	WATER PUMPED.		REMARKS.
		TOTAL QUANTITY.	PER FAMILY.	
1852..	....	235,840,275	....	
1853..	4,283	303,531,743	70,868	
1854..	4,619	376,265,126	81,460	
1855..	5,282	542,807,364	102,765	
1856..	5,706	692,124,305	121,297	
1857..	6,189	697,190,523	112,650	
1858..	6,474	718,091,207	110,919	
1859..	6.794	782,112,587	115,118	
1860..	6,750	870,036,451	125,185	
1861..	7,128	895.129,423	125,579	
1862..	7,275	994,945,329	136,762	
1863..	7,699	1,035,798,043	134,534	
1864..	7,993	1,019.390,256	127,410	
1865..	8,351	1,040,514,887	125,675	
1866..	9,089	1,196,317,922	131,622	
1867..	10,342	1,425,535,230	139,186	Average per cent. of increase from 1852 to 1888—12.86.
1868	11,544	1,666,545,125	144,364	
1869..	12,774	1,946,810,325	152,400	
1870..	13,722	1,866,060,068	136,000	
1871..	14,896	2,300,150.605	154,414	
1872..	16,035	2,782,292,578	173,513	
1873..	17,019	3,198,393,948	187,930	
1874..	18,853	3,289,872,635	174,511	
1875..	19,606	4,207,454,260	214,600	
1876..	20,102	4,065,134,470	202,225	
1877..	20,345	4,213,239,790	207,090	
1878..	20,603	4,345,743,830	210,927	
1879..	21,341	5,129,599,110	240,348	
1880..	22,465	5,552,965,310	247,183	Average per cent of increase from 1879 to 1888, inclusive, 8.5.
1881..	23,749	6,543,127,968	279,722	
1882..	25,442	6,284,000,742	243,062	
1883..	27,415	7,379,327,788	269,170	
1884..	29,424	8,510,614,140	289,260	
1885..	30,533	9,970.829,580	326,886	
1886..	31,946	10,576,571,254	331,070	
1887..	34,486	13,168.859,808	381,860	
1888..	36,863	**14,380,166,670**	**390,098**	
1889..	39,158	12,875,334,453	328,880	*Commenced Metering.*
1890..	41,467	12,120,944.532	292,300	Average per cent. of decrease since 1888, 11¾.
1891..	43,983	12,057,261,236	274,470	
1892..	46,400	12,276,612,482	264,582	

A glance at the right hand column will give the fact that the *pro rata* quantity for each family supplied, increased from 70,000 gallons in 1853 to 390,000 in 1888, an average annual increase of 12.86 per cent., and an average increase during the ten years previous to 1888 of 8.5 per cent.

In consideration of the fact that in London, Eng., where waste is reduced to a minimum but about 55,000 gallons is the *pro rata* per family per annum, and in Providence, where meters are almost in general use, the *pro rata* is less than 75,000, I cannot but believe that this column of figures, with its broad base of 390,000 gallons in 1888, is but a monument to the ever-growing habit of wastefulness in man, and that 'the figures thereafter, with those of 1888 as a base, form another column which is fast becoming a monument to the efficiency of the meter system.

COST OF PUMPING WATER.

For the purpose of proving that the average cost of pumping one million gallons of water has been, with the use of coal, $4.45, I have prepared a table giving the exact expenses each year for the past ten years :

YEARS.	NO. OF GALLONS PUMPED.	TOTAL ANNUAL EXPENSE.	COST PER MILLION.	REMARKS.
1883..	7,379,327,188	$30,678 72	$4 15	
1884..	8,510,614,140	32,172 81	3 78	
1885..	9,970,829,580	35,531 53	3 56	
1886..	10,576,571,254	36,628 19	3 46	
1887..	13,168,859,808	57,352 94	4 35	Pressure increased.
1888..	14,380,166,670	60,284 11	4 19	
1889..	12,875,334,453	61,560 48	4 82	
1890..	12,120,944,532	54,443 49	4 49	
1891..	12,057,261,236	53,012 77	4 39	Rate reduced by use of oil Nov. and Dec.
1892..	12,276,612,482	53,287 39	4 27	

Previous to 1887 the average cost was less, but that year and since, with certain variations due almost entirely to the character of the coal purchased, the average cost previous to 1892 has been $4.45. This increase is due to the fact that in 1887 the

Reservoir was abandoned and the pressure materially increased hroughout the city.

INTRODUCTION OF METERS.

In the spring of 1889, the placing of meters was commenced and has been steadily and systematically continued until, at he close of the year, all, practically, of the manufacturing and business interests of the city are so supplied. The causes that ed to this step and some of the results therefrom have been fully discussed in my previous reports.

I desire, however, to reprint a table that appears in my report of 1890. To me it is a convincing argument of itself, for the use of meters, and fully illustrates the injustice of selling water to consumers under the system of assessments made by estimating, or rather *guessing* what the quantity is that is being consumed.

A, B, C, etc., represents certain consumers in the city.

The second column shows the quantity of water that each one was found to be consuming by attaching meters to their service pipes.

The third column shows the amount each paid monthly previous to being metered.

The fourth column shows the rate per 1000 gallons that each one paid under the assessment plan.

CONSUMERS.	MONTHLY CONSUMPTION AS PER METER.	MONTHLY ASSESSMENT.	PAID FOR 1,000 GALLONS.
A..............	583,500 gals.	$7 50	1¼ cents.
B..............	132,000 "	2 00	1½ "
C..............	3,429,803 "	36 66	1 "
D..............	531,375 "	33 33	6¼ "
E..............	185,250 "	13 67	7⅖ "
F..............	2,697,831 "	119 16	4⅖ "
G..............	472,201 "	39 66	8⅖ "
H..............	259,312 "	17 50	6¾ "
I..............	138,850 "	28 33	20 "
K..............	727,125 "	50 00	6⅞ "
L..............	2,127,050 "	53 33	2½ "
M..............	270,750 "	37 66	14 "
N..............	1,352,850 "	142 00	10½ "
O..............	462,818 "	43 00	9⅓ "

It will be seen by the above statement that but one of these consumers paid 20 cents per 1,000 gallons, which is the rate charged when the quantity is estimated, while one paid only *one* cent per 1,000 gallons, or one-twentieth of the amount charged the former.

It is a well known principle of good government that the most careful espionage should be maintained upon the weights and measures that are in use for the purpose of measuring the quantities of articles that are for sale; and yet, in every community where the assessment plan is in operation, the people collectively are selling water to themselves individually by means of a measure that is more like an elastic bag than anything else, that expands for some and shrinks for others.

FINANCIAL SAVING EFFECTED.

To properly estimate the *financial* saving effected by the restrictive measures adopted by the Board, it will be necessary to make an estimate of the quantity of water that would have been pumped each year had the circumstances remained the same. By an examination of the first table it will be seen that the average increase in the *pro rata* for each family during forty years has been $12\frac{86}{100}$ per cent. and that this per cent. for the past ten years has been $8\frac{5}{10}$.

Using this latter per cent. of increase we have the following table.

YEARS.	FAMILIES SUPPLIED.	WATER PUMPED—ESTIMATED.	
		TOTAL QUANTITY.	PER FAMILY.
1889	39,158	16,573,858,448	423,256
1890	41,467	19,042,973,344	459,232
1891	43,933	21,890,320,178	498,266
1892	46,400	25,084,675,200	540,618

The total quantity of water, according to this estimate, that would have been pumped during the four years, is 82,591,827,170, and the quantity that was actually pumped was 49,330,152,703, showing a saving of 33,261,674,467. By reference to the

cond table it will be seen that the cost of pumping one mil-
on gallons of water, for five years previous to 1892 has been
the rate of $4.45 per million. Multiplying the number of
llons of water saved by the cost of pumping, shows a saving
$148,014.45 in the expense of pumping water alone.

The extension of the Works which seemed imperative upon
e Board in the spring of 1889, and which your honorable
ody estimated would cost at least $600,000, has been saved
lso, at least up to the present time. The interest upon this
mount would have been $24,000 per annum, and for four
ears $96,000.

The meters including superintendency and every other ex-
ense incident to their introduction have cost the Board dur-
ng the four years $80,224.47.

The Superintendent of the meter department reports that the
resent valuation of these meters in service and in stock, in-
luding tools, etc., is $71,618.37.

In conclusion then we have the following:

METERS.	DR.	CR.
To Expense	$80,224.47	
By present values		$ 71,618.37
By pumping expenses saved		148,014.45
By interest saved		96,000.00
	$80,224.47	$315,632.82
Balance in favor of the meters		$235,408.35

REDUCTION IN WATER RATES.

One year ago, in your report to the Common Council, these words were used, "*The cost of running the water department of any city, depends largely upon the quantity of water which the Works are called upon to supply. If the supply can be reduced so can the cost. If the cost can be reduced so can the rates for water; and that precisely is what your Commissioners are doing to-day.*"

I think I have already proved conclusively all except the last proposition, and now let us see about that

I am again obliged to have recourse to a tabular statement which shows first the years, second the total number of families supplied, third the total rates received, and fourth the *pro rata* amount for each family.

YEARS.	FAMILIES.	WATER RATES.	PER FAMILY.	WOULD HAVE RECEIVED AT AVERAGE $10.21.
1876	20.102	$205,624 74	$10 22	
1877	20,345	210,288 12	10 33	
1878	20,603	208,193 95	10 10	
1879	21,341	218,110 13	10 22	
1880	22,465	227,452 73	10 12	
1881	23,749	241,884 32	10 18	
1882	25.442	261,725 79	10 28	
1883	27,415	280,049 06	10 21	
1884	29,422	300,467 24	10 21	
1885	30,533	313,205 10	10 25	
1886	31,946	314,952 31	9 85	$326,168 66
1887	34,486	322,834 59	9 36	352,102 06
1888	36,863	344,315 26	9 34	376,371 23
1889	39,158	367,925 27	9 39	399,803 18
1890	41,467	387,877 73	9 35	423,378 07
1891	43,933	389,079 97	8 85	448,555 98
1892	46,400	402,534 98	8 67	473,744 00

There was a reduction in the rates in 1886. I have taken ten years previous to that, simply to establish this fact, that when the schedule of rates is unchanged, notwithstanding the fact that the rates received are from all purposes, business as well as families, the *pro rata* per family remains practically the same.

In 1876 the *pro rata* was $10.22, and in 1885, ten years after, the *pro rata* was $10.25. The average *pro rata* for these ten years was $10.21, by which I can multiply the number of families supplied each year and ascertain almost the exact amount that would have been received, had the same rates been in force.

In the year 1886 the Board reduced the rate for household purposes for a family to $5.00 per annum. This went into effect July 1, and affected the receipts of that year for six months only. In 1887, 1888, 1889 and 1890 the average *pro* *ata* was reduced to $9.36, which caused a reduction in our eceipts of over $30,000 per annum.

In 1891 the hose tax was abated, the reduction being about $20,000 per annum, affecting the receipts of one-half of 1891, but all of 1892. At this time the meter rates were also reduced from ten cents per 1,000 gallons, first to six and two-third cents, then to five cents, and finally to three and one-third cents where it now stands.

The *pro rata* of 1891 was reduced to $8.85 and that of 1892 to $8.67, making the receipts of the latter year, affected by all these reductions, $71,209.02 less than they would have been under the schedule of six years ago, and this reduction is due as follows:

To reduction in rates for family use	$30,000 00
" " " hose tax	20,000 00
" " " meter rates	21,209 02

This amount, $71,209.02, the Board are saving each year directly to the water rate payers, and are still enabled to meet all outstanding obligations, the expense of operating the Works and also of all construction and extension, which, on account of the rapid growth of our city and increased limits, has necessarily been very large.

METER RATES.

As shown by last year's report, there is no city in the world that supplies water as cheaply to the ordinary consumer as Detroit, *300 gallons of water for one cent!* Considerable has been said at various times as to whether the placing of meters did not discriminate against those who were thus supplied. Let us see. Last year we supplied to the entire consumption that was metered 1,589,885,250 gallons, for which we received $61,585.62, or .038 cents for each 1,000 gallons.

During the same time we supplied all the consumption that was not metered 10,686,727,232 gallons, for which we received $340,949.36, or for each 1,000 gallons, .034 cents.

It must be remembered, however, that the unmetered consumption includes all water for the Fire Department, and all water for parks, fountains, etc. Could this amount be eliminated from the gross amount, I have no doubt but that the rate for 1,000 gallons under either manner of distribution would be the same, or nearly so.

OIL PLANT.

During the year 1891 the attention of the Board was attracted to the use of crude oil as a fuel, and information and results of experiences were sought for far and wide. The Board finally became perfectly satisfied that with proper combustion, 168 gallons of oil equaled in duty one ton of coal, and as oil could probably be contracted for at about one and one-half cents per gallon, and as coal had cost the Board in the coal houses on an average of $4.25 per ton, it was safely estimated that there would be, under proper conditions, a saving of $1.73 per ton of coal, or upon the basis of the consumption of 1890 (7616.50 tons), a saving annually of $13,176.54.

On the 20th day of April, 1892, a contract was entered into with the National Supply Co., of Chicago, for an Oil Plant complete, including a pipe line of 10,000 feet to R. R. track in the sum of $12,500.

The Plant consists of two tanks, each with a capacity of 1,873 barrels, inclosed in a brick house neat and tastefully constructed with corrugated iron roof, a suction pipe to boilers with two Snow Duplex Pumps in boiler house connected in batteries to be used alternately, and two oil burners under each of four boilers with the necessary steam and oil connections thereto.

The Pipe Line is of 3-inch wrought iron pipe and runs from Tank House through grounds to Jefferson avenue, west on Jefferson to Baldwin, north on Baldwin to Champlain, west on Champlain to Bellevue, thence north to Kercheval, and west again to Belt Line R. R. track. The line pump station house is built on the west side of this track and on a line with Kercheval street, is of brick and contains two Duplex Snow Pumps with 8-inch steam cylinder, 4-inch oil cylinder and 10-

h stroke, and a 20-horse vertical boiler trimmed. The entire gth of the pipe line is 12,412 feet.

The pumping station is 29 feet above the tank house and the number of gallons that can be discharged through the pipe by gravity alone is 33¼ gallons per minute.

The pipe line will hold 113 barrels of oil, but which can be pumped out by means of an extra suction pipe connected with the pumps in the boiler house.

The boilers at the Works are Marine boilers and the same that were placed there about 16 years ago, and though by no means the best adapted for the burning of oil, or coal for that matter, yet the results so far have been fully up to the expectation of the Board.

During the months of August, September and October, a portion, about two-fifths, of the fuel consumed was of coal, as the Board desired to relieve the pressure against the walls in the coal house, which gave evidence of giving way, and which it became necessary to repair immediately.

In November, oil was used exclusively and showed a saving of over $1,000 as compared with the coal then in use.

In December the saving effected amounted to $1,112. This saving is estimated on the old price of coal, $4.25 in the coal house. If the present price of coal be taken into consideration, and I think it should as the price of oil undoubtedly is affected thereby, this saving is practically over $600 more a month. The average monthly consumption of coal in 1890 was 634 tons, which at the present market price would have cost the Board at least $5.25 per ton. Another saving by the use of oil is that of labor, which I have not spoken of before. Our force at the pumping works is reduced as follows:

One fireman, salary per month	$55 00
Three coal passers, each $45 00	135 00
Total saving each month	$190 00

or $2,280 each year.

THE NEW ENGINE.

During the months of July and August there was such a prolonged season of heat and drought as to be almost, if not quite, an epidemic.

At certain times during the day, so great was the consumption of water at this time that all three of the engines were required to satisfy the demand, pumping some hours at the rate of three million gallons per hour. This was the first time in the history of the Works that it became necessary to run the three engines at the same time, which was not due in the least to the increased uses or increased consumption owing to the growth of the city, inasmuch as the total amount pumped during the year was much less than in 1887.

It was nothing more nor less than an epidemic, and an epidemic that was possible to occur again, and for that reason the Board of Water Commissioners deemed it its imperative duty to prepare for its recurrence.

It is an absolute necessity that there should be at all times one engine in reserve, as accidents and breakages are liable to occur, in fact are sure to occur, as our experience teaches us. Had the slightest occurred at the time above referred to, a great many consumers would have been deprived of water, especially in the northerly portions of the city.

For these reasons it was determined by the Board to purchase another engine, notwithstanding the fact that the annual consumption is steadily but surely decreasing. It was the strongly expressed wish of the Board, in referring this matter to Commissioner Kirby for investigation, to procure an engine of the very latest improved pattern, and one that would perform the work required at the very least expense.

Commissioner Kirby visited various cities and examined their pumping engines, and Chief Engineer Edwards and First Assistant Engineer Gould also visited Chicago and examined engines in operation there, and all were impressed with a preference for the Vertical Triple Expansion Engine manufactured by the Edward P. Allis Company. Proposals were solicited from that company and also from Henry Worthington to furnish a Triple Expansion Engine, with foundation and boilers complete for operation. The Edward P. Allis Company's proposal was for a vertical engine for $90,000, and that of Henry Worthington for a horizontal engine for $87,000. The proposal of the former was considered the smallest of the two and was accepted by the Board.

The description of this engine is as follows:

It is guaranteed to deliver 24,000,000 gallons in 24 hours against a head of from 116 feet to 135 feet, and to develop a duty of 130,000,000 foot pounds for each 100 pounds of coal (best anthracite), in a 24-hours' test, and to develop a duty of 120,000,000 foot pounds for each 100 pounds of coal in a continuous test of 30 days, and to be supplied with steam at a pressure of 125 pounds per square inch. The steam cylinders will be 3 in number, one high pressure cylinder 28 inches in diameter, one intermediate cylinder 48 inches in diameter, and one low pressure cylinder 74 inches in diameter, all having a stroke of 60 inches.

There is to be 4 horizontal tubular boilers 62 inches in diameter by 20 feet long, each boiler to contain 49 4-inch tubes.

Contracts were also entered into for the extension of the engine house on the west end to correspond with the previous extension on the east end in the sum of $22,000, which also includes the extension of the boiler house. This work has already commenced and is well under way. The entire cost of all construction, necessary to the operation of the engine, will be $140,000.

DOCK.

It became a matter of necessity to do something in the way of repairing or rebuilding the dock, as it had reached such a dilapidated condition as to be not only an unsightly object but dangerous even to walk over. This dock forms the dividing wall between the canal and the settling basin and extends into the river about 800 feet beyond the south line of the basin, being in all 1,900 feet long.

It was determined by the Board to simply rebuild that portion extending out beyond the basin, and to leave the balance untouched until next season, when, unless some good reason should arise opposed to such action, to remove entirely that portion between the basin and canal, thus making the former larger to that extent.

Since the Board discontinued the purchase of coal as a fuel the canal and dock have ceased to be useful, and are certainly far from being ornamental, and it is the present opinion of the Board to do away with what will continue to be, as long as it exists, a source of endless expense.

INLET PIPES

The contract with Capt. Thos. Davis, of the season of 1891, to take up and relay what is known as inlet pipe No. 1, and to extend the same into the river 500 feet farther, was not completed until about August 1st, 1892.

The diver employed to inspect the condition of this pipe, as well as that of the other two inlet pipes, reported that in one instance he found an opening between the ends of the pipes large enough to admit the insertion of a hand, and that in a great many other instances the joints were by no means water tight, in fact that such a condition was almost an impossibility with the most careful attention unless packing was used. The Committee on Pumping Works were instructed by the Board to put these pipes in perfect condition, and the result was that under instructions from the committee, a contract was entered into in the sum of $900 with H. F. Dwyer to caulk every joint thoroughly with packing in all the three inlet pipes.

This was accomplished thoroughly and to the satisfaction of the committee.

Inlet pipe No. 2, running alongside the dock and which is 500 feet shorter than the other two, was found in a bad condition. From near the shore to within about 100 feet from the end of the dock, the pipe has gradually worked upwards until about 200 feet of it is not more than two feet beneath the water. This portion of the line, it was discovered, had been packed at the joints with cement, sewed up in bags, and which were placed in the bell end and hardened there. This cement had in the hardening process somewhat contracted, and at a number of places had broken and crumbled away. This inlet pipe from the strainer to about 100 feet north of outer end of dock was found in a good condition and was carefully packed by Mr. Dwyer.

It was, however, determined by the committee to do nothing further with this pipe, and to abandon the use thereof until some time in the future, when, if it was thought best, that portion nearest the shore could be taken up and relaid, and the whole be extended 500 feet farther into the river to correspond with the other two pipes.

FIRST PUMPING POWER.

Through the courtesy of Henry Plass and his sister, Mrs. Wm. H. Hopson, the Board are now in possession of the first pumping power used in the city of Detroit to supply its citizens with water.

In the year 1825 Bethuel Farrand, father of Jacob S. Farrand, and Rufus Wells, commenced the construction of Water Works under an act of the Common Council entitled "An act granting to Bethuel Farrand and his legal representatives the sole and exclusive right of watering the City of Detroit, and for other purposes."

Soon after Mr. Farrand transferred his interests to Mr. Wells, and in 1827 the Works were pronounced complete and the water introduced.

The pump house was erected at the foot of Randolph street. It was a frame building 20 feet square and had a cupola 40 feet high. The water was raised by two pumps of 5 inches bore, driven by *horse power* into a 40-gallon cask at the top of the cupola. From thence the water was led through tamarac logs of 4½ inches interior diameter to the reservoir which was situated where the Water Office now is.

The reservoir was 16 feet square and 6 feet deep, and was constructed of two-inch white oak planks caulked with oakum and placed on a timber frame 16 feet high and covered with a shingle roof. Water was distributed from this reservoir through a line of logs 3¼ inches bore.

The *horse power* referred to is the one now in possession of the Board.

Mr. Henry Plass has furnished the Board with its history since its abandonment by the city in the year 1830. It was superseded by a 10-horse-power engine driving a rotary pump and forcing the water through a 3-inch iron pipe, a piece of which pipe is on exhibition at the Pumping Works today. The horse power was sold to Mr. Fairbanks who four years after sold it to Gabriel Chene by whom it was used in grinding apples. In 1858 the late Henry Plass purchased it of Mr. Chene and used it for some time in his cider mill located on Atwater street. In 1866 he removed it to his farm in Grosse Pointe. It was here continued in its old service of grinding apples until 1878 when, in the words of Mr. Plass, "it stopped short never to go again."

This horse power has been removed to the Pumping Works and it is the intention of the Board to have it set up in some convenient place and preserved as an object of interest and curiosity.

CHIEF ENGINEER JOHN E. EDWARDS.

In the year 1860, thirty-two years ago, John E. Edwards was appointed Chief Engineer of the Works, and during all the intervening years has been a valuable and faithful official. The three large engines at the Pumping Works, which have been and still are objects of wonder and admiration, were designed by him, and, at the time of their construction, excelled in economical operation anything of their kind in the country, and even to-day, notwithstanding the progress made in this branch of engineering, are surpassed by few.

It had become apparent to the Board, however, during the year that is past, that Mr. Edwards, now in the 72nd year of his life, should be relieved from the active duties of his posion, and in order that it might still retain the benefit of his knowledge and experience, appointed him Consulting Chief Engineer. A memorial prepared under the instructions of the Board and signed by the members thereof, was presented him which fitly expresses the prevailing sentiments of his employers, his associates and those who are acquainted with him.

PURITY OF THE WATER.

From time to time, there emanates from some source a doubt, and sometimes a direct denial, of the purity of the water supplied the city. We did not escape this the past year; in fact considerable agitation prevailed in the public mind, inasmuch as the origin of the assertion of its impurity was of such authority as to almost demand credibility.

It happened however very fortunately for the Works and the people that at this time Dr. J. E. Clark, a recognized authority in chemical analysis, was just completing a paper to be read before the Detroit Chemical Society, in which the purity of Detroit River water was treated exhaustively.

He closes his paper with these words: "*The result of my analysis demonstrates clearly that the water supply of our city is unexcelled, for purity, by that supplied to any other large city in the Union.*"

His paper together with an analysis made by the Health Officer, Dr. Samuel P. Duffield, will be found at the close of this volume.

I presume now that we can rest in peace, for a few years at least, as far as the unquestionable purity of the water is concerned.

COMPARATIVE STATEMENT.

The following table showing conditions of the past five years is very interesting. There is hardly a line that does not speak volumes to any one interested in the growth of our city and an economical administration of its affairs.

The most important fact however, as far as the Water

Works and its management is concerned, is forcibly illustrated in the two lines "Estimated population" and "Operating expenses."

From 1888 to 1892 the population has increased 46,000 with all its attendant factories and business interests and the expense for operating the Works instead of increasing in the same proportion has actually decreased $2,251.00.

COMPARATIVE STATEMENT.

	1888.	1889.	1890.	1891.	1892.
Daily average consumption in gallons.....	39,397,716	35,274,888	33,208,067	33,033,592	33,634,554
Daily average consumption per capita.....	204	172	155	144	140
Total consumption in the year............	14,380,166,670	12,875,334,453	12,120,914,532	12,057 261,236	12,276,612,482
Consumption through meters, gallons.....	91,750,000	139,090,000	626,944,765	1,194,842,400	1,589,885,250
Percentage of water metered.............	.00⅝	.01	.05⅙	.10	.13
Revenue from unmetered water..........	$335,140.00	$354,016.00	$350 599.73	$342,395.89	$340,949.36
Revenue from metered water	$9,175.00	$13,909.00	$37,278.00	$46,684.08	$61,585.62
Per one thousand gallons metered water...	.10	.10	.059	.038	.038
Per one thousand gallons unmetered water	.023	.027	.03	.031	.034
Number of families supplied	36,863	39,158	41,467	43,933	46,400
*Estimated population..................	192,730	203,992	214,122	228,254	238,683
Number of service connections...........	31,821	37,725	40,351	43,727	47,281
Miles of pipe..........................	325	343	362	405	432
Number of meters......................	48	204	866	1,239	2,053
Expenditures for maintenance............	$101,019.00	$102,587.00	$102,391.00	$95,591.54	$99,561.52
Actual operating expense...............	$93,783.50	$93,931.00	$95,746.85	$88,086.62	$91,534.82

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* Obtained by multiplying number of families by 5.08, an average arrived at by dividing three U. S. Census by the number of families found the same years by the assessors.

FINANCIAL STATEMENT.

The following is a complete statement of the financial transactions of the Board for the past year.

RECEIPTS.

WATER RATES ACCOUNT:	
Rates paid	$402,534 98
PERCENTAGE ACCOUNT:	
From delinquents	6,316 50
Penalties for shutting off	865 00
CITY OF DETROIT ACCOUNT:	
Tax levy	74,483 94
INTEREST ACCOUNT:	
Deposits, general fund	4,146 42
Deposits, sinking fund	1,762 17
REAL ESTATE ACCOUNT:	
Rents for office building	1,000 00
Rents for old pumping works	1,387 50
REPAIRING LEAKS ACCOUNT:	
Labor	176 62
SERVICE COCKS ACCOUNT:	
Stops, drilling and fines	8,026 70
IRON PIPE ACCOUNT:	
Bonus, laying extensions	3,325 38
Material and labor	4,371 49
PLUMBERS' LICENSE ACCOUNT:	
Paid for licenses	580 00
PUMPING WATER ACCOUNT:	
Sale of old material	30 00
Sale of ashes	15 00
METER ACCOUNT:	
Sale of old material	13 30
OIL PLANT ACCOUNT:	
Sale of lumber	75 58
PUMPING WORKS ACCOUNT:	
Rent of canal	250 00
Total receipts	$509,360 58

he following are the expenditures of the Board classified er their different heads:

CONSTRUCTION.

Pipe Account:		
Superintendent and clerks	$5,980 16	
Labor	75,567 60	
Pipe	77,628 61	
Specials	5,543 66	
Hauling	1,596 14	
Lumber	843 36	
Coal	262 71	
Oil	31 12	
Packing	375 50	
Office materials	41 68	
Tools and repairing of	677 85	
Lead	13,162 96	
Plugs	192 39	
Repairs and materials for	83 67	
Repaving	1,188 67	
Street car and toll tickets	58 15	
Livery	85 75	
Damages	60 63	
Wagon and harness supplies	200 21	
Feed	402 99	
Farrier	135 75	
Lead pipe, solder, nails, etc	128 82	
Horses	405 00	
Repairing culvert	15 95	
Phaeton	100 00	
Bonus repaid	32 50	
		$184,801.83
Stop Cock Account:		
Labor	$430 35	
Valves	6,110 37	
Boxes and covers	2,302 39	
Repairs and materials for	56 07	
		$8,899 18
Meter Account:		
Superintendent and labor	$8,269 17	
Meters	12,371 82	
Freight and express	63 75	
Tools and repairing of	158 13	
Lumber, lead, etc	884 31	
Cartage and street car tickets	180 33	
Specials and fittings	1,090 49	
Horse, wagon, feed, etc	547 24	
		$23,565 24

PUMPING WORKS ACCOUNT:		
Architect	$675 00	
Relaying inlet pipe contract	5,225 00	
Labor	541 28	
Tools and repairing of	4 14	
Materials for repairs	251 85	
Rebuilding dock	5,900 00	
Repairing Hydrants	12 00	
Diving	74 00	
Packing inlet pipes	1,056 50	
Boat	30 00	
Removing piles	356 47	
Damages	150 00	
Engineer's expenses to Chicago	41 25	
Enlarging engine house contract	2,000 00	
		$16,317 49
REAL ESTATE ACCOUNT:		
Insurance	$293 09	
Changes and repairs of buildings	1,725 12	
Reservoir fence, materials and labor	345 01	
		$2,363 22
OIL PLANT ACCOUNT:		
Original contract	$12,500 00	
Extra from contractor	1,278 66	
Lumber, lead pipe, etc	710 59	
Repaving	10 00	
Coal shed	21 59	
Boiler cover, stop and express	42 85	
Meter	45 13	
Extra burners	40 47	
		$14,649 29
Total construction expenses		$250,596 25

OPERATING EXPENSES.

PUMPING WATER ACCOUNT:		
Engineers and firemen	$18,400 42	
Coal	25 61	
Natural gas	20,936 86	
Fuel oil	7,306 75	
Polish	25 75	
Repairs and materials for	3,268 98	
Lubricators	278 64	
Supplies—rags, waste, etc	123 70	
Supplies—tools, etc	118 84	
Express	25	
Car tickets	5 00	
Stationery and postage	6 80	
		$50,497 60

PAIRING LEAKS ACCOUNT:

Labor	$6,335 72	
Tools and repairing of	186 32	
Car tickets	190 00	
Wagon and harness supplies and repairs	47 80	
Feed	148 12	
Leather coats	18 00	
Farrier	53 50	
		$6,979 46

ELEPHONE:

Rent		$419 40

RCENTAGE ACCOUNT:

Labor	$1,725 00	
Feed	24 48	
		$1,749 48

ERVICE COCKS ACCOUNT:

Clerk and labor	$7,368 76	
Materials, tools and repairs of	144 82	
Valves, branches and cocks	1,920 71	
Tapping machine	1,350 00	
Repairing pavements	53 37	
Wagon and harness supplies and repairs	268 40	
Horses	375 00	
Feed	104 30	
Tickets	10 00	
Farrier	56 75	
		$11,652 11

FFICE ACCOUNT:

Secretary, assessors and clerks	$19,325 00
Printing and binding	1,331 23
Advertisements and subscriptions	166 14
Watchmen and janitor	1,071 00
Supplies—soap, matches, etc	223 89
Supplies—stationery	322 74
Water Works association dues	3 00
Furniture, fixtures and repairs of	362 72
Extra services	602 45
Fuel	474 93
Light	241 05
Postage	51 00
Attorney	600 00
Expert examiners	40 00
Germicide	33 00
Sprinkling	85 32
Ice	23 10
Street car tickets	24 00
Counterfeit money	13 25

Lost money	$5 00	
Horseshoeing, etc.	161 00	
Feed	52 79	
Carriage harness and repairs	178 21	
		$25,390 82

INSPECTION ACCOUNT:

Labor	$2,872 65
Total operating expenses	$99,561 52

HURLBUT FUND.

Superintendent and labor.	$2 842 35	
Materials, lumber, etc	36 38	
Green house expenses	190 72	
Tools and repairs	60 00	
Hitching posts	18 00	
Seeds, plants and pots	79 26	
Gravel	595 43	
Settees	192 00	
Sprinkling cart	42 00	
Wagon and harness repairs	25 00	
		$4,081 14

INTEREST ACCOUNT.

Interest on bonds	$76,905 00

RECAPITULATION.

Construction	$250,596 25
Operation expense	99,561 52
Hurlbut fund	4,081 14
Interest	76,143 91
Aggregate expenditures for 1892	$431,143 91

ACTUAL COST OF OPERATION.

To obtain this there should be deducted from the total expense for maintenance the sum of $8,026.70, which was received from plumbers for material and labor, in furnishing service cocks, valves, sleeves, etc., for service connections, the cost of which is charged to this account. This would leave, as the actual cost of operation, $91,534.82.

STATEMENT.

hand January 1, 1892	$94,035 35	
s for the year	509,360 58	
		$603,395 93
ed in 1892	$431,143 91	
hand January 1, 1893	172,252 02	
		$603,395 93

onorable Board of Water Commissioners of the City of Detroit:

TLEMEN:—Under instructions from the Committee on and Means, we have carefully examined the books and rs of the Water Works from January 1st to December 892, and find them correct.

hand in office	$4,106 63
rcial National Bank, general fund	119,249 24
rcial National Bank, sinking fund	48 896 15
	$172,252 02

Respectfully submitted,

(Signed) DANIEL R. PIERCE,
JOHN HOSMER.

COLLECTIONS IN DISTRICTS UNDER OLD ARRANGEMENTS.

YEAR.	1st District, Wards 7 and 9.	2d District, Wards 3 and 5.	3d District, Wards 1 and 2.	4th District, Wards 4 and 6.	5th District, Wards 8 and 10.	6th District, Wards 12, 14 and 16.	7th District, Wards 11, 13 and 15.		Meters.	Aggregate.
1886-7	....	....	....	....	$11 25	....	....	....	....	$11 25
1887-8	....	....	....	....	24 25	....	....	....	....	24 25
1888-9	....	$2 50	$2 00	$5 00	14 00	....	....	....	....	23 50
1889-90	$7 00	7 50	12 50	9 75	17 75	....	....	....	....	54 50
1890-1	10 00	31 00	33 00	38 50	42 00	$25 50	$10 75	....	....	190 75
1891-2	21,665 69	21,571 53	29,228 87	26,969 39	23,016 11	20,277 49	21,866 03	....	$26,752 12	191,347 23
Total...	$21,682 69	$21,612 53	$29,276 37	$27,022 64	$23,125 36	$20,302 99	$21,876 75	....	$26,752 12	$191,651 48

COLLECTIONS IN DISTRICTS AS RE-ARRANGED JULY 1st, 1892.

YEAR.	1st District, Wards 9 and 15.	2d District, Wards 11 and 13.	3d District, Wards 1 and 7.	4th District, Wards 3 and 5.	5th District, Wards 2 and 6.	6th District, Wards 10 and 14.	7th District, Wards 4 and 12.	8th District, Wards 8 and 16.	Meters.	Aggregate.
1892-3	$22,024 45	$16,760 89	$26,230 29	$22,622 62	$28,636 09	$19,140 58	$23,494 07	$17,141 01	$34,833 50	$210,883 50
									$61,585 62	$402,534 98

ASSESSMENT REPORT.

The following table is a statement of the assessment made in May and June and going into effect July 1, 1892. The whole number of families in the city at that time was 46,985.

The assessments amount to $335,694, and, as the report shows that there were taken from the assessment rolls for the purpose of metering, places aggregating on former rolls $12,364, this sum should be added to the "gain" as shown in table, $4,985, to show the real gain, which is $17,349.

There have been taken from the assessment rolls for the purpose of metering during the last four years, places whose aggregate assessments amounted to $62,240. In addition to this there have been metered all places of business and factories that have been established in the meantime.

The aggregate upon the assessment rolls of '92-3 is still a little over $3,000 more than that of 1888.

WATER RATES.

Assessment for the Year 1892–1893.

WARDS.	Families.			Family Tenements found Vacant.	Increase Assessed.	Assessment.		
	Assessed.	Not Assessed.	Whole Number.			1892-93.	Increase or Decrease.	$ reduced by use of meter.
1st Dist.—								
Ninth	4,583	34	4,617	71	175	$27,140	+$1,332	62
Fifteenth	1,915	76	1,991	40	464	12,409	+ 2,570	214
Total	6,498	110	6,608	111	639	39,639	+ 3,902	276
2d Dist.—								
Eleventh	3,167	10	3,177	68	133	19,616	+ 716	295
Thirteenth	2,112	29	2,141	58	157	13,028	+ 850	146
Total	5,279	39	5,318	126	290	32,644	+ 1,566	441
3d Dist.—								
First	2,441	18	2,459	104	98	29,728	— 2,585	3,681
Seventh	3,040	26	3,066	67	140	19,929	+ 1,215	139
Total	5,481	44	5,525	171	238	49,657	— 1,370	3,820
4th Dist.—								
Third	3,145	25	3,170	85	59	21,079	— 699	861
Fifth	3,568	14	3,582	65	72	22,063	+ 217	506
Total	6,713	39	6,752	150	131	43,142	— 482	1,367
5th Dist.—								
Second	2,014	3	2,017	106	— 15	28,814	— 4,884	4,575
Sixth	3,355	2	3,357	167	106	25,480	+ 1,259	182
Total	5,369	5	5,374	273	91	54,294	— 3,625	4,757
6th Dist.—								
Tenth	3,883	4	3,887	67	157	24,428	+ 548	433
Fourteenth	2,012	63	2,075	38	169	12,222	+ 1,104	75
Total	5,895	67	5,962	105	326	36,650	+ 1,652	508
7th Dist.—								
Fourth	2,912	6	2,918	98	50	27,332	+ 124	787
Twelfth	2,956	12	2,968	60	157	17,820	— 159	181
Total	5,868	18	5,886	158	207	45,152	— 35	968
8th Dist.—								
Eighth	3,134	9	3,143	84	131	21,607	+ 1,250	185
Sixteenth	2,130	254	2,384	35	406	12,431	+ 2,089	40
Springwells	33	......	33	......	8	478	+ 88	.....
Total	5,297	263	5,560	119	545	34,516	+ 3,377	225
Aggregate	46,400	585	46,985	1,213	2,467	$335,694	+ $4,985	12,364

The amount expended for the new Works to January 1st, 1893, is as follows:

ITEMS.	EXPENDED PREVIOUSLY.	1892.	TOTAL.
Land	$35,000 00	....	$35,000 **00**
Force Mains	609,414 77	....	609,414 **77**
Inlet Pipes	84.271 34	$6,355 50	90,626 **84**
Dock Basin and Canal	129.409 12	5,900 00	135,309 **12**
Conduits and Conduit Wells	73,710 52	....	73,710 **52**
Engine Boiler and Coal Houses	161,164 04	2,968 10	164,132 **14**
Stand Pipe and Tower	30,420 72	....	30,420 **72**
Pump Wells	54.221 56	....	54 221 **56**
Engines	265,642 24	....	265,642 **24**
Boilers	44 248 40	....	44,248 **40**
Engineer's House	7,773 14	....	7,773 **14**
Sewer	3,666 25	....	3,666 **25**
Grounds	50,551 18	4.081 14	54.632 **32**
Inspection	2,977 86	....	2,977 **86**
Miscellaneous	8,756 83	1,093 89	9,850 **72**
Total	$1.561,227 97	$20,398 63	$1,581,626 **60**

VALUATION OF THE WORKS.

The following is an inventory of the properties of the Board as invoiced by the several heads of departments.

RECAPITULATION.

Office building and lot	$60.000 00	
Three lots, Orleans street	41,250 00	
Reservoir grounds and improvements thereon.	47,200 00	
Oil pumping station	14,649 29	
Grounds at new pumping works	250,000 00	
Buildings, docks, basin conduits, etc	752,877 60	
Water-pipe laid and in use	2,994,850 37	
Meters placed and in use	68,733 99	
		$4,229,561 25

TOOLS AND MATERIAL ON HAND.

In office building	$9,073 63	
In repair department	2,107 45	
In meter department	2,884 38	
At reservoir grounds, horses, trucks, etc	4,423 97	
At reservoir grounds, pipes specials, etc	26,755 54	
At Inspector's department	632 00	
At new pumping works	23,222 74	
		$69,099 71
Aggregate		$4.298,660 96

INVENTORY OF THE WORKS.

OFFICE.

Office building and lot	$60,000 00	
Counter in office	1,041 00	
Furniture in Board room	583 13	
Fourteen office tables	215 00	
Six bookcases	660 00	
Three wardrobes	335 00	
Six desks	173 00	
Thirty-six office chairs	91 50	
Twelve office stools	45 00	
Eight city maps	20 00	
One marble office clock	100 00	
Three atlas maps	50 00	
Partitions in office	800 00	
Railing in office	50 00	
Heating apparatus	1,400 00	
Electric light fixtures	55 00	
Miscellaneous properties	100 00	
Horse, harness, buggy and appurtenances	335 00	
Upstairs—		
One cabinet desk	30 00	
One small desk	10 00	
One upright desk	10 00	
Three bookcases	80 00	
One table	10 00	
One cabinet drawing table	50 00	
Two drawing tables	35 00	
Drawing tools	70 00	
Maps and drawings	2,500 00	
Chairs	10 00	
Safe	200 00	
One clock	15 00	
		$69,073 63

PUMPING WORKS.

Three lots corner Atwater and Orleans street	$41,250 00

REPAIR DEPARTMENT.

Tools and materials	$2,107 45

OIL PUMPING STATION.

Cost of plant erected in 1892	$14,649 29

METER DEPARTMENT.

Valuation of meters in use	$68,733 99	
Valuation of meters in stock	1,975 65	
Valuation of tools	309 72	
Valuation of material in stock	175 01	
Horse, wagon and harness	424 00	
		$71,618 37

RESERVOIR.

Grounds including houses	$47,200 00	
Railroad siding	637 97	
Seven horses	1,050 00	
Five repair wagons	200 00	
One mud wagon	50 00	
Two sleighs	120 00	
One large truck	200 00	
Two light trucks	300 00	
Storage platform	400 00	
Seven pipe derricks	700 00	
Harness, covers and blankets	250 00	
Tools and material	516 00	
		$51,623 97

STOCK AT RESERVOIR.

Iron pipe	$13,493 75	
Specials	4,178 64	
Gates and valves	1,036 00	
Gate boxes	48 00	
Lead	6,213 19	
Packing	86 67	
Oil	2 60	
Coal	16 69	
Scrap iron	1,680 00	
		$26,755 54

INSPECTION.

Six carts	$500 00	
Six set of harness	90 00	
Six horse covers, rubber	9 00	
Six horse blankets	18 00	
Two pair runners	15 00	
		$632 00

NEW PUMPING WORKS.

Grounds	$250,000 00	
Inlet pipe	86,020 47	
Dock and basin	69,825 72	
Engine boiler and coal houses	127,391 23	
Stand pipe and tower	29,804 25	
Engines	255,000 00	
Boilers	31,500 00	
Engineer's house and barn	6,000 00	
Conduits and wells	72,187 06	
Pump wells	53,648 58	
Drawbridge and foundation	5,000 00	
Drinking fountain	175 00	
Underground improvements	16,325 29	
		$1,002,877 60

TOOLS AND MATERIALS.

....	$1,068 35	
ial (rope, waste, etc)	829 96	
ial (gauges, valves, etc)	754 34	
ial (iron, lead, etc)	1,016 78	
ture	372 45	
and coal	14,956 93	
and vehicles	126 00	
ng engine, gas and electric light plant d supplies	3,450 51	
and implements (Hurlbut fund)	647 42	
		$23,222 74

IRON PIPE IN GROUND.

3 feet 45 inch pipe	$1,699 50	
9 feet 42 inch pipe	612,177 14	
5 feet 36 inch pipe	6,587 35	
7 feet 30 inch pipe	322,404 86	
4 feet 24 inch pipe	358,157 93	
1 feet 20 inch pipe	1,751 80	
7 feet 18 inch pipe	278 40	
9 feet 16 inch pipe	89,855 08	
8 feet 12 inch pipe	12,227 38	
0 feet 10 inch pipe	155,437 47	
5 feet 8 inch pipe	236,941 22	
1 feet 6 inch pipe	630,387 48	
6 feet 4 inch pipe	527,704 27	
5 feet 3 inch pipe	38, 488 39	
0 feet 2 inch pipe	752 10	
		$2,994,850 37
219 feet		
Aggregate		$4,298,660 96

Respectfully submitted,

L. N. CASE,

Secretary.

REPORT OF SUPERINTENDENT OF METERS AND INSPECTION.

DETROIT, January 2, 1893.

To the Board of Water Commissioners:

GENTLEMEN—In compliance with the rules of your honorable body, I herewith report the work done in the meter and inspection departments during the year 1892.

The following tables show the number of meters placed, the number removed, and the total number in service on the 31st day of December, 1892:

Placed.

	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Total number of meters placed during the year 1892	510	245	135	15	24	14	6	949

Removed.

	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Premises vacant	21	7	6	2	5	2	2	45
For repairs	14	2	16	3	5	2	2	44
Too small for required supply	9	5	4	3	6	......	......	27
Too large for required supply	......	1	7	......	1	......	......	9
Total number removed	44	15	33	8	17	4	4	125

Meters in Service.

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
eters in service Jan. 1, 1892.	457	175	364	69	95	47	20	2	1,229
eters placed during the year, and in service Jan. 1, 1893	466	230	102	7	7	10	2	......	824
tal number of meters in service Jan. 1, 1893......	923	405	466	76	102	57	22	2	2,053

The following tables show the kind and sizes of meters laced during the year, also those removed:

Placed.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
homson	502	244	129	14	18	12	4	...	923
rown	3	1	3	1	2	1	......	......	11
ersey..	......	......	3	......	......	1	2	......	6
orthington	4	......	......	......	4	......	......	......	8
nion Rotary............. ...	1	......	......	......	......	......	......	......	1
Total placed	510	245	135	15	24	14	6	......	949

Removed.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson.................	27	12	8	5	6	1	1	......	60
Crown	9	2	6	2	2	.....	. ..	......	21
Hersey............	1	1	11	1	1	2	3	......	20
Worthington..................	5	.....	4	......	8	....	....	....	17
Union Rotary.................	2	......	4	......	......	1	.... .	......	7
Total removed.............	44	15	33	8	17	4	4	......	125

The following table shows the total number of meters in service and the different kinds and sizes, also indicators attached to hydraulic elevators:

KIND.	SIZES.									
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Indicat'rs	Total
Thomson...............	858	383	350	57	63	37	7	2	......	**1,757**
Crown	39	16	48	11	13	8	4	. ..	......	**139**
Hersey................	3	4	44	2	12	1	7	......	......	**73**
Worthington......	14	2	18	4	12	10	3	......	....	**63**
Union Rotary..........	9	......	2	2	2	1		......	....	**17**
Duplex	.....	......	2	.. ...	......	.. ...		......	......	**2**
Equitable........	.... .	......	1	......	......	......		.. ...	......	**1**
Ball & Fitts............	.....	......	1	......	......	....	.....	......	.... .	**1**
Indicators...	.....	....	......	......	......	...	.....	......	8	**8**
Total No. in service Jan. 1, 1893.......	923	405	466	76	102	57	22	2	8	**2,061**

Meters in Stock.

KIND.	SIZES.							
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	Total
Thomson (New)....	34	12	3	8	4	......	1	**62**
Crown	13	2	5	1	.....	1	......	**22**
Hersey	1	1	8	1	1	1	1	**14**
Worthington	3	2	4	......	......	......	. ....	**9**
Union Rotary	3	......	5	......	. ...	.. ..	......	**8**
Total number in stock...........	54	17	25	10	5	2	2	**115**

Valuation of meters in stock, January 1, 1893................	**$1,975 65**
Valuation of material in stock, January 1, 1893..............	**175 01**
Valuation of tools, January 1, 1893........................ ..	**309 72**
Valuation of horse wagon, etc., January 1, 1893.............	**424 00**
Total.. .	**$2,884 38**

Valuation of meters in service, January 1, 1892	**$50,187 49**
Deduct 10 per cent. for depreciation in value	**5,018 74**
Present valuation of meters in service, January 1, 1892	**45,168 75**
Add amount expended during the year for meters placed.....	**23,565 24**
Total valuation of meters in service, January 1, 1893...	**$68,733 99**

Cost of material used in repairing meters in 1892............	**$5 28**
Cost of labor in repairing meters in 1892.....................	**254 00**
Total...	**$259 28**

mary of total amount expended in the meter department years 1889, 1890, 1891 and 1892:

	1889	1890	1891	1892	Aggregate
....	$11,175 00	$18,700 00	$ 6,501 55	$12,371 82	$ 48,748 37
labor..........	1,734 10	8,510 57	4,841 49	8,269 17	23,355 33
tools, etc......	637 26	2,982 14	872 99	2,132 93	6,625 32
auling, etc....	98 05	408 97	197 11	244 08	948 21
gon, etc.......	....	....	.. ..	547 24	547 24
....	$13,644 41	$30,601 68	$12,418 14	$23,565 24	$ 80,224 47

ng the last year we have placed 824 meters, and adding o the number in service on the first day of January, akes a total of 2,053 meters in service on January 1st,

year brings additional proof of the necessity and justice neter system. Nothing can be more evident than that asurement of water to each consumer is the only true arrive at the proper amount each should pay. So long e is to be a price for water there is no other way to make harge other than for the amount consumed. It is simply ble to estimate waste correctly, and there is where a roportion of the water goes to, as the quantity pumped t 140 gallons per head per day, while in cities that are d the quantity is about 45 gallons, and that is a large e, for some cities are much lower, especially that of the Liverpool, England, where it is only 13 gallons.

claim that they should not be restricted in the use of by placing a meter on their premises, but we tell them not restrict its use. If they find it necessary to use s much as their neighbor there does not seem to be any eason why they should not pay twice as much for it. If t just for everybody to pay for the amount consumed e only way left would be to have each consumer pay the mount and use much or little as the case might be with- ard to cost of furnishing it. Where it might cost only to furnish a certain quantity to one person his neighbor ase what would cost ten or a hundred dollars to furnish, and yet if they are not to pay according to the quantity consumed the latter should have his for one dollar the same as the former. Of course the hundred dollar fellow would not object, but the one who only used one dollar's worth would, for he ought not to help pay for the one who used the larger amount, and that is just what he would have to do and is what the water takers have been doing and will continue to do under the old system of estimating the quantity used. As I said before it is simply impossible to estimate the waste and in many cases very difficult indeed to estimate the legitimate uses.

With good plumbing and proper attention nobody need fear the meter. It is harmless in itself, but they must not expect it to remain quiet when the water is going to waste. It is placed there principally for the purpose of preventing the same and it is a very faithful servant, remaining on duty night and day for three hundred and sixty-five days in the year and is seldom caught napping, as quite a number of consumers can testify.

I have a few cases that are quite interesting showing the value of the meter. One firm of manufacturers who had been using from 20,000 to 25,000 cubic feet per month jumped to 225,000 cubic feet one month, and it was a mystery to know where so much water could have gone, as they had been running just the same as usual. Of course the first thing to do was to condemn the meter, as it is always looked upon as the guilty one, until proven to the contrary, but as is generally the case—as in this —the meter was not at fault. The firm had employed a new engineer and said engineer had been with them nearly a month before discovering that there was a meter on the premises. They had a 2-inch service pipe leading to a tank from which they took their supply, said tank—not having an automatic shut off—when full overflowed into the sewer, and the engineer having turned on the water, thought it necessary in order to keep the tank full to leave it turned on all the time with the foregoing result, that is, consuming 225,000 cubic feet instead of 25,000 cubic feet, or eight times more than was necessary, and in all probability they would have continued to use it in the same l it not been for the meter. A few days ago I had a ıe from a person "to send a man to his store immediately p the meter." I asked him if *it* was going away, he but he had the water all shut off from every portion of ding and the meter kept going along just the same and ed it stopped. On sending to examine it he found it matter to stop it and did so by turning the water off in in a portion of the building occupied by a tenant e had overlooked.

quite a common occurrence to have the consumption from 35,000 cubic feet per month to two or three l cubic feet in same length of time, after the first meter been presented. In metering places where the rates en paid in advance, the occupant has a month or two acing the meter to see how much water he is using, and makes a wonderful reduction in the amount before he ıces to pay by meter measurement.

ne assessment of $64 per year including a block of nd one family and a smaller building containing family ce, the larger building assessed at $52 and the smaller $12. The first two months showed a consumption of ubic feet on the larger building, and 44,800 on the one, or nearly five times more water on an assessment than on an assessment of $52. Of course in the smaller ; it was very nearly all waste, the legitimate uses being o or three hundred feet while the waste was from seven y-five thousand feet per month caused by what we call a set which does not shut off automatically and when on usually remains so, unless it affects the supply in ortions of the building.

years ago your honorable body adoped a rule prohibiting re of said closets being put in, and I think it would be a ı the right direction to order all now in use changed to ng ones of some kind; either that or place a meter on

are quite a number of places we would like to meter not for the expense. In former years the number of connections for each building was not limited, so that in case the owner wanted water in some portion of his premises where he could make connection with the main pipe at a less cost than he could make the extension from the one already in, he was allowed to do so; and now when we want to meter the premises we find as many as three connections requiring three meters, where the whole amount of water used could easily be supplied through one $\frac{5}{8}$-inch connection. I should think it advisable in such cases to compel the owner to connect his pipes in such a manner as to take his whole supply through one pipe where it is practical to do so, or else make a minimum charge for each meter, which would—in many cases—produce the same results, but as it is at present, with a minimum price for total amount consumed, regardless of the number of meters, permits the consumer to ask for a meter on each connection, without any extra charge.

During the last year we have metered all new connections to be used for manufacturing and other business purposes together with stores and business places where the assessment was $9 per year or upwards. Nine dollars being the present minimum price per year for each premise metered we have not placed them on premises where the assessment has been less than that amount in order not to increase the assessment unless the consumption warranted it. But our examiners find a large waste in many places where the assessment is only five or six dollars per year, and I think it would be wise to make a smaller minimum rate so that all such places could be metered.

INSPECTION.

In this department, we still continue the house to house inspection, but with only four examiners instead of five, as last year. About one-third of their time is occupied in reading meters and delivering bills each month. As the work in the meter department increased, one of the examiners was transferred permanently to said department, thinking the four remaining would be able to give all the time necessary for the examination leaks, but so much of their time has been taken up in the ading of meters and delivering bills that they have not been le to get over the city twice as in former years, which, I think, counts for the increased percentage of leaks reported.

They have made 50,288 examinations, reported 3,335 leaks, which 3,053 were repaired and 282 ordered shut off for failg to comply with notice. The percentage of leaks reported number of examinations made in 1891 was 4.77 per cent., d in 1892 it was 6.63 per cent., showing that it will be necesry, in order to keep the waste from increasing on unmetered emises, to make at least two examinations throughout the ty each year.

The same course has been followed as last year. The occuant has been given a stated time to repair the leak, and at the piration of said time, if the repairs are not made, the water ordered shut off, unless it was in two or three cases where e owners were in destitute circumstances and not able to make e repairs, and to have shut the water off would have been ruel. In those cases we made the repairs ourselves with the en employed in the leak department, and at times when they ere not busy with other work.

The change made early in the year in regard to plumbers' cense—that is, giving all plumbers a first-class license and then olding them to a rigid compliance with our rules and regulaons governing plumbers and plumbing—has given good satisction to the plumbers and caused everything to move without iction in this department. I think there is better plumbing eing done throughout the city than ever before—that is, so ar as our inspection extends. As we have nothing to do with the anitary part of it, we have paid very little attention to that ortion of the plumbing, but, from what we have seen, think here is a great field for the proper authorities to labor in. The wners, in most cases, appreciate our efforts to have that porion of the plumbing over which we have control done to our atisfaction, but occasionally we find a person who insists on aving his plumbing done to suit himself, regardless of our ules—such as using any kind of lead or iron pipe, putting in any kind of fixtures and getting the work done by any tinker who comes along, making no report of the work and utterly ignoring the Water Department in every respect. In one particular instance of this kind, after we had notified the owner to have the work changed to comply with our rules, and, he refusing to do so, we attempted to shut the water off from the premises, when, as you are aware, the Water Board was served with an injunction preventing them from interfering with the water on said premises. Until the case comes to trial and is settled, we are not quite sure what rights we have in this matter, but if the Water Board does not have the right to say what material shall be used in the plumbing of buildings, order the necessary changes made when not in compliance with our rules, and also to prohibit any person without license from interfering with the water pipes in any way, then inspection would be a farce and of no earthly benefit. If all rights end at the corporation stop on the lot line, inspection would be of little use, for ninety nine per cent. of the leaks occur between the stop and the different outlets on the premises.

The following table shows the work of the examiners in the eastern and western divisions during the year 1892:

	Examinations.	Leaks Reported.	Leaks Repaired.	Ordered Shut Off.
East of Woodward ave	25,009	1,871	1,716	155
West of Woodward ave	25,279	1,464	1,337	127
Total	50,288	3,335	3,053	282

The following table shows the duties performed by the ospectors of new work during the year 1892:

	Calls for Non-payment.	Shut for Non-payment.	Examined New Connections.	Examined Exten's and Fixtures.	Let on New Connections.	Notified for Building Tax.	Shut for Vacancy.
ohn Hatzenbuehler	1,169	265	836	529	21	91	42
ichael Hart	1,197	552	6 8	421	354	70	61
ohn Becker	1,322	423	420	292	326	156	95
J. Paterson	1,176	437	506	263	377	151	187
ohn Promstatter	836	238	664	501	214	99	29
dolph Jasnowski	1,161	268	500	481	97	40	......
TOTAL	6,861	2,183	3,5[illegible]4	2,487	1,579	607	414

Attached to this report is a complete list of tools on hand, nd an itemized account of the material in stock on the 31st ay of December, 1892.

In conclusion, I take great pleasure in acknowledging the niform kindness shown me by your honorable body, and specially by the Secretary, who has upon all occasions so heerfully given me his careful attention and advice when alled upon, and who has so ably conducted the general management of the Works.

The employés under my supervision are entitled to due credit or the faithful performance of their work and their willingness o do duty at all times, either day or night, when called upon o to do.

All of which is respectfully submitted.

T. R. PUTNAM,
Superintendent Meters and Inspection.

REPORT OF SUPERINTENDENT OF GROUNDS.

To the Honorable Board of Water Commissioners:

Gentlemen,—As the year 1892 is drawing to a close, it becomes my duty to report to your honorable body progress during the year.

Early in the season, with the prospect of an early settlement of the Hurlbut will, your committee instructed me to beautify the grounds rather more than usual, by planting flowers and improving the roadways, and I am glad to say that the fifty or more flower beds about the grounds assisted very much to make the place attractive.

The number of visitors was largely in excess of that of former years.

The permission of the Board to allow visitors to go about over the lawn was very much appreciated and did not injure the grass during the summer months, excepting some special places, and in my opinion such places, being short cuts, should be made into good gravel paths.

The iron settees were a great convenience, and at times even there were not sufficient of them to supply the large number of visitors present.

The gravel put on the road-beds during the summer was very much needed and improved the appearance of the park wonderfully. No part of the general park work needs closer attention than the roadways, which should always be nicely edged and smoothed. Owing to the heavy loads hauled over our roadways at times, I think it would be a good plan to macadamize the main road from the avenue to the engine house. As the road already has a pretty good foundation of large stones, it would be only necessary to remove the top dressing build up in the usual way with stones broken the proper side drains being put in at the same time. We could then the road in good condition all seasons of the year.

e road sprinkler was not finished in time to be of any use season, but will be a great benefit the coming summer.

ting under instructions from your committee, I built a l green house, 12 x 106 feet, at an expense for material of undred and eighty-eight dollars. It will be a great con- ence, although too small for very extensive floral work.

Now that the Hurlbut will is settled, I would recommend me permanent improvements. One of the first things needed an iron fence for the Jefferson ave. front. This, I understand, s already been arranged for. It will greatly improve the pearance of the grounds, as the present fence, both in front d on each side, obstructs to a considerable extent the view of e park in approaching and passing it.

Another very much needed improvement is a ladies' toilet om, which I would advise locating south of the tower over e thirty-inch waste pipe.

I would suggest a building with the first floor fitted for the clusive use of ladies, with a sitting room and toilet rooms, ith all the ordinary toilet room fixtures at hand. Then have outside stairway leading to the top floor for general use, hich should be almost entirely glass sides, without partitions obstructions of any kind, except necessary supports for the of. A brick building, with stone trimmings, hardwood finish nd everything complete, large enough for all purposes, could be built for about twenty-five hundred dollars.

There is also needed very badly a convenient shelter for horses and carriages.

We are now digging a ditch along the west fence from the river to a point four hundred feet south of the engineer's residence, and with three or four cross ditches hope to drain the marsh, so as to stop the growth of flags at least.

There are quite a number of maple trees set in the grounds, some of them several years ago, that will never amount to anything as ornamental shade trees, and I think it would be a good plan to put elm trees in the place of them. Maples are attacked by borers more than any other kind of tree in the park. Although we are continually doing what we can to promote the growth of the trees, it seems impossible to get maples to do well.

I am also in favor of planting a number of evergreen trees. Although our generous benefactor, Mr. Hurlbut, did not fancy them, I think it would improve the park very much to have a hundred or so set in clumps about the grounds. Quite a number could be planted along the east line and also a few south of the basin and along the canal bank far enough away so that leaves would not be blown into the basin.

Accompanying this is an invoice of tools, etc., on hand in this department.

Respectfully submitted.

E. A. SCRIBNER,
Superintendent of Grounds.

ORT OF CHIEF ENGINEER AT PUMPING WORKS.

DETROIT, January 1, 1893.

oard of Water Commissioners:

LEMEN—I have the honor to submit the Engineer's or the year 1892.

following table shows the number of gallons of water , and cost of fuel for the years named:

EAR.	GALLONS OF WATER PUMPED.	COST OF FUEL CONSUMED.	AVERAGE DAILY DELIVERED.
	235,840,271	....	646,411
	303,531,743	$2,129 37	931,594
	376,265,126	2,271 34	1,030,866
	542,807,364	3,325 81	1,487,148
	692,124,315	4,017 44	1,896,231
	697,190,523	3,983 20	1,909,887
	718,091,207	3,655 20	1,967,373
	782,112,587	3,194 15	2,142,774
	870,036,451	4,196 21	2,388,580
	895,129,423	4,414 07	2,452,409
	994,945,829	3.150 95	2,725,878
	1,035,798,043	4,670 86	2,837,803
	1,018,390,256	7,647 62	2,839,078
	1,049,514,887	7,372 89	2,875,383
	1,196,317,922	9,349 16	3,277,583
	1,425,535,230	10,121 82	3,905,576
	1,668,545,125	11,379 23	4,507,248
	1,946,810,325	11,247 92	4,511,809
	1,866,060,068	12.713 78	5,112,493
	2,300,150,605	14,681 05	6,301,782
	2,782,292,578	17.736 86	7,601,892
	3,198,393,948	20,233 30	8,762,723
	3,289,872,635	20,431 71	9,013,850
	4,207,454,260	21,393 98	11,527,272
	4,065,134,470	19,832 89	11,107,499
	4,213,239,790	17,433 72	11,543,123
	4,345,743,330	10,943 82	11,906,146
	5,129,599,110	11,219 51	14,053,696
	5,552,965,310	12,276 60	15,172,036
	6,543,127,968	16,556 63	17,926.377
	6,284,000,742	13,156 16	17,261,440
	7,579,327,188	16,495 99	20,217,334
	8,510,614,140	19,877 07	23,253,044
	9,970,829,580	21,341 48	27,317.341
	10,576,571,254	20,887 24	28,976,907
	13,168,859,868	35,882 83	36,079,166
	14,380,166,670	39,568 66	39,397,716
	12,875,334,453	34,413 31	35,274,888
	12,120,944,532	31,352 40	33,209,067
	12,057,261,236	33,826 86	33,083,592
	12,476,612,482	31,031 40	34,182,499

The following tables show in detail the work done by each engine each month of the year.

ENGINE No. 1.

MONTHS.	Time run. H.	Time run. M.	Revolutions.	Gallons.	Cost of Kindling.	Pounds of Coal.	Cost of Coal.	Cost of Nat. Gas.	Gallons Fuel Oil.	Cost of Oil	Total Cost.	Duty.
January	714	10	419,762	324,805,788	$1 88	150,089	$303 18	$607 06	....	....	$912 12	74,655,935
February	384	....	224,365	173,658,510	....	37,336	75 41	379 15	....	....	454 56	78,647,405
March	....	....	....	....	....	....	....	....	....	....	....	....
April	346	50	176,826	136,863,821	....	....	....	381 97	....	....	381 97	75,766,133
May	342	20	153,879	220,441,392	1 88	1,107	2 23	622 71	....	....	626 82	73,742,676
June	520	.	248,802	385,145,496	....	....	....	1,055 37	....	....	1,055 87	74,605,322
July	614	40	306,527	174,503,796	....	....	....	1,228 74	981	$14 71	1,243 15	76,617,271
August	509	55	267,467	414,038,916	....	160,062	323 33	68 79	36,098	541 48	933 60	76,753,587
September	241	15	122,719	189,969,012	....	102,575	207 20	....	14,084	211 26	418 46	76,683 190
October	389	40	187,356	290,027,088	....	183,306	370 28	....	21,320	319 80	690 08	76,841,154
November	....	....	....	....	....	....	....	....	....	....	....	....
December	440	...	243,260	188,283,240	....	....	....	....	23,485	352 27	352 27	77,454,047
Total	4,502	50	2,350,963	2,797,827,062	$3 76	634,475	$1,281 63	$1 343 79	95,968	$1,439 52	$7,068 70	....

ENGINE No. 2.

MONTHS.	Time run. H.	Time run. M.	Revolutions.	Gallons.	Cost of Kindling.	Pounds of Coal.	Cost of Coal.	Cost of Nat. Gas.	Gallons Fuel Oil.	Cost of Oil	Total Cost.	Duty.
January	255	35	150,226	241,241,808	....	218,509	$441 38	$292 44	....	....	$733 82	74,775 082
February	305	...	170,5 2	137,139,888	....	37,954	76 66	309 93	....	....	386 59	78,680,963
March	744	....	392,522	315,587,688	....	50,496	102 04	779 82	....	....	881 86	78,918,574
April	151	40	80,428	64,664,112	....	3,054	6 16	174 54	....	....	180 70	76,205,250
May	467	45	257,679	377 001,228	$1 88	....	....	993 33	....	....	995 21	73,592,895
June	716	....	405,075	651 358,992	....	....	....	1,784 90	....	....	1,784 90	74,871,239
July	604	25	350,312	547,416 012	....	....	....	1,417 68	....	....	1,417 68	76,633,652
August	113	45	56,684	45,573,936	....	17,405	35 15	7 47	3,928	$58 85	101 47	77,687,889
September	231	25	163,446	131,412,102	....	71,110	143 64	....	9,749	146 24	289 88	76,027,816
October	195	10	114,944	150,666,526	....	94,772	191 43	....	11 069	165 88	357 31	76,868,975
November	375	50	211,257	169,850,628	....	....	....	....	20,201	808 01	808 01	76,890,871
December	90	35	48,050	39,355,800	....	....	....	....	4,878	78 08	78 08	77,082,954
Total	4,251	10	2,401,896	2,871,298,820	$1 88	493,300	$996 46	$5,760 11	49,804	$747 06	$7,505 51	....

MONTHS	Time run. H.	M.	Revolutions.	Gallons.	Cost of Kindling.	Pounds of Coal.	Cost of Coal.	Cost of Nat. Gas.	Gallons Fuel Oil.	Cost of Oil.	Total Cost.	Duty.
January	504	...	306,782	550,107,000	$1 88	148,076	$288 08	$1,208 80	....	....	$1,498 76	74,707,554
February	696	..	395,505	711,909,000	....	162,972	285 90	1,680 02	....	....	1,965 92	78,698,518
March	744	..	400,497	729,894,000	....	90,814	201 62	1,775 70	....	....	1,977 32	78,908,981
April	720	...	386,141	696,053,800	....	5,870	11 85	1,968 57	....	....	1,980 42	75,807,694
May	300	..	192,506	316,510,800	1 88	3,321	6 70	1,019 35	....	....	1,027 93	78,708,972
June	...	...	....	....	....	....	....	....	....	....	....	....
July	168		91,378	169,871,400	....	....	....	139 85	1,690	$25 35	165 20	76,655,587
August	742	30	414,101	745,881,800	....	288,037	581 83	123 90	64,961	974 46	1,680 19	76,590,491
September	720	....	425,089	705,147,600	....	416,183	748 66	....	56,060	854 83	1,603 49	76,081,614
October	660	...	393,628	690,530,400	....	379,210	766 06	....	44,221	663 32	1,429 38	76,706,827
November	720	...	403,217	725,700,000	....	....	....	....	89,697	1,846 46	1,846 46	76,068,684
December	744	...	431,105	775,989,000	....	....	....	....	96,922	1,458 88	1,458 88	76,632,100
Total	6,718	30	3,781,937	6,807,480,000	$3 76	1,190,518	$3,022 91	$8,113 28	354,458	$5,817 24	$16,437 19	....
Aggregate	15,472	30	8,531,700	12,470,612,182	$9 40	2,624,288	$5,310 01	$18,217 18	500,255	$7,508 82	$31,081 40	....

Fuel consumed	$31,081 40
Salaries, engineers and firemen	18,402 42
Coal for pumping oil	25 61
Polish	25 75
Repairs and materials for repairs	3,208 98
Lubricators	278 04
Rags, waste, packing, etc	123 70
Tools and supplies	118 81
Express	25
Street car tickets	5 00
Stationery and stamps	6 80
	$53,287 80

Cost per million gallons, $4 27.

Engines One and Two were run part of the time with one pump attached.

It will be seen by the tables the water pumped during the year is but little more than in 1891, although the city has rapidly increased in population. This is accounted for by the stoppage of waste which seems to be more thorough each succeeding year.

With the new triple expansion engine and high pressure boilers which will be ready for use about July, we will be in much better condition to supply the higher districts in the city with a satisfactory head of water, and such additional as to meet any increased demand for some time to come.

In December, 1889, we began the use of natural gas for fuel and continued using it until September of this year. Our experience with natural gas was very satisfactory when the volume was sufficient, but several times it failed so suddenly that we did not have sufficient time to get steam on our cool boilers soon enough, causing a short supply of water for several minutes.

In August we began preparation for the use of fuel oil which we have been using for about three months with the most satisfactory results, being easy to control when properly applied and also a great saving over anthracite coal which has been used nearly since the building of the new works. It was found impracticable to use bituminous coal for the reason that soot would be blown into the settling basin and pumped into the mains.

Our oil burners and connections were put in by the National Supply Company, who furnished burners as good as any we know of. Our boilers being of the fire box marine pattern, it was a question with Engineer Edwards whether the burner should go into the fire box through the furnace doors or under the boiler front which is about fourteen inches below the grate bars used for coal. He, however, decided to put them at the lower point mentioned which has proved too low, for the reason that the intense heat on the lower edge of the side sheets caused such commotion that instead of sediment depositing in the legs of the boiler as before, it has been thrown on the flues and other parts of the boiler where it bakes on, to the injury of the boilers and reducing the duty.

By advising with your committee we concluded to fit up our o. 4 boiler with oil burners set about twenty inches nearer e crown sheet and to arrange a system of bridge walls that ould conduct the right volume of air to the exact point eeded, and the result has been entirely satisfactory.

We get perfect combustion and also distribute the heat very enly over the proper heating surface. Another advantage f having our boilers fitted in this way is that we can in a very w minutes change from oil to coal in case of a failure in the pply of the former. I would recommend changing those in e east room for the aforesaid reasons.

For full description of oil plant see secretary's report.

There is a certain property of fuel oil that clings to a pipe hrough which it flows. It cannot be called sediment for the eason that it forms evenly on the inside surface of the pipe, radually reducing the opening until the pipe stops up com-letely, making it necessary to have duplicate lines between the oilers and receiving tank.

We have two duplex pumps with independent suctions and a ystem of pipes and valves so arranged that we can put on full oiler pressure of hot water on either of our supply lines for he purpose of cleaning them out. Hot water is far more ffective than steam.

We find that fuel oil should be given as little vent as possible s oil left exposed to the atmosphere will lose its gaseous roperties and become thick and almost useless for fuel.

The engines are in fair order with the exception of No. 1 ngine which I hope to improve by removing a heavy weight rom the fly wheel which was placed there for a balance weight when the engine was built. By placing a proper weight on he pump piston, I am confident the engine will run considerably moother and easier.

The suction boxes of the three engines are submerged be-eath the water, and at the ordinary level in the river have nearly four feet on the boxes. Early this spring, however, the water became so low that it was deemed necessary to guard against possible "loss of priming," by having hoods constructed reaching from the top of the suction boxes to within a foot of the bottom of the well. No further anxiety need be felt therefore even if the water should become four feet below the present level, which is not at all likely.

Repairs on boilers the past year have been considerable, but they are now in fair condition considering their age.

We had four of the Ford mechanical boiler cleaners put on the boilers in the east room June 1st, 1890, and on Oct. 1st, 1890, we had four put on the boilers in the west room. This boiler cleaner is simply a convenient surface blow-off and does not keep the boilers clean as they are represented to do, as we have found it necessary to use considerable boiler compound in order to maintain boilers in condition. I am sorry to say that we have not found as yet any mechanical device that will prevent scale, or any compound that will dissolve scale so that the boilers can be washed out clean, without taking out flues every two or three years.

I would suggest that hereafter all well strainers should be made of the perpendicular bar pattern instead of perforated plate, for this reason: the bar strainer can be thoroughly cleaned without delay. I would recommend having one of this pattern put into the west well where the new connection is to be made. I hope the new discharge connections will be made so that when a new discharge main is laid, either engine can be run independently with either main. The advantage of this is considerable, for the reason that only the required pressure need be kept on each main and the engines could be run slower when required without interfering one with the other, making quite a saving of fuel.

The new addition of forty-seven feet to the west end of the engine house, which is now under way, will make the building look more symmetrical and give ample room for the new engine.

The coal sheds are not in good condition, but as we are not likely to use them for some time, I see no necessity for repairing them immediately as it would be quite an expense.

Respectfully submitted,

URIAH GOULD,
Engineer.

REPORT OF THE SUPERINTENDENT OF EXTENSION AND CONSTRUCTION.

DETROIT, January 2d, 1893.

To the Board of Water Commissioners:

GENTLEMEN: In accordance with the regulations of your Honorable Body, I have the honor to present my annual report relative to the general condition and progress of the work in this department.

During the past season not less than thirty-seven miles of pipe has been laid.

It would seem from the tenor of our last year's report, that the extensions to our pipeage system would be greatly curtailed for the past year, because we expected the calls for extensions in this branch of the work would not be very numerous. We have, however, in this been doomed to disappointment, and although we are condoling ourselves with the hope that the calls upon this department of the work may not be as numerous the coming year, it is nevertheless an unknown quantity. The city now covers an area of about 29 square miles, its greatest length being about 7½ miles, and its width about 5¾ miles.

Continually new streets and avenues are being opened, and outside of, and adjacent to the boundary lines of our city are many suburban sections already laid out in streets and building lots, awaiting with gaping mouths for the best of beverages from our source of supply. So in view of these facts, I fear we may not soon get a very long breathing spell but must keep on our wearing apparel and our hands to the plow. It may be well to say right here, that owing to the great amount of paving being done the past season it has been the cause of much additional work [illegible].

Among the chief of our lines laid the past year have been the following. The completion of the 24-inch main in the North Boulevard, from Sullivan to the west line of Grand River Avenues, and from this point on said Boulevard a 16-inch main was laid to 14 feet west of the West Boulevard. A 16-inch main was laid in Buchanan Street, from the intersection of the 30 and 24-inch mains in said street and Vinewood Avenue, to Livernois Avenue, a distance of 5,550 feet, and to which all the streets and avenues have been connected thereto where water mains have been laid, and at such points where new streets have been opened, and where no pipe has as yet been called for, suitable branches have been placed for future use. The gap in the 24-inch main in Cass Street between Fort and Congress Streets was also laid. This completes the line from Fort Street to Jefferson Avenue. A line of 12 and 10-inch pipe has been laid in Gratiot Avenue, with good results. This line was laid from St. Aubin to Rivard Street with the 12-inch pipe, connecting with the 24-inch main in Orleans Street and to all lines crossing the same. The 10-inch pipe was laid from Rivard Street to the intersection of Gratiot avenue, Mullett and Raynor Streets, connecting with the 30-inch in Mullett Street. The laying of this line has greatly relieved the overdrawn pipes and mains in this locality. A 10-inch main was laid in Cleveland Street, from St. Aubin to Elmwood Avenues; and from Elmwood Avenue to Burlage Place, an 8-inch was laid to replace several sections of 3 and 4-inch pipe and wooden logs. This line has made an excellent cross-feed to this section of the city, the 10-inch pipe being connected with the 30-inch main in Chene Street. A line of 8 and 10-inch pipe was laid in Jefferson Avenue from McClelland Avenue to about 800 feet east of the easterly city line and from this a line of 10-inch pipe was laid in the Pumping Works grounds, connecting with the 30-inch main leading to the stand-pipe.

Thirty-one lines of extensions have been made with 8-inch pipe, ranging in lengths from 100 to 3,500 feet, 12 of which were laid to replace wooden logs and 3 and 4-inch iron pipe in the following streets and avenues: Burlage place, from Cleveland to Waterloo Streets; Calhoun Street, from Chene Street to Grandy Avenue; Eighth Street from Grand River Avenue to Brigham Street; Grandy Avenue, from Gratiot Avenue to Pierce Street; Leland Street, from Dequindre Street to McDougall Avenue; McDougall Avenue, from the north line of Gratiot Avenue to Preston Street; Russell Street, from Congress to Macomb Streets; and from Gratiot Avenue to Maple Street; Sherman Street, from Orleans to Russell Streets; Waterloo Street, from Burlage Place to Mt. Elliott Avenue; Wilkins Street, from Chene to Orleans Streets; and in alley east of Woodward Avenue, north of Gratiot Avenue; 28,985 lineal feet were laid to meet the 31 lines mentioned above, making an average of 935 feet per line.

The laying of new, and extending of the old lines of 6-inch pipe in 166 different places, have averaged about 564 lineal feet per line of pipe, ranging in lengths from 12 to 4,600 feet, or a total length of 93,580 feet.

I find by carefully looking over the records of our pipeage, that 31 new mains of streets and avenues have been added to our list of streets in which pipe has been laid, the same ranging in lengths from 50 to 2,500 feet.

It is quite probable that the calls for pipe the coming season will not exceed 12 inches in diameter as it now presents itself.

It is very gratifying to see the disappearance of some of the smaller lines of pipe, and pipe of much larger size taking its place in many of the streets and avenues of the older portions of our city. Nothing less than 6-inch is being laid north and south, and the preference will be for 8 and 10-inch pipe, seeing it is the wish of your Honorable Body that a bountiful supply shall be had in all portions of the city.

I believe we have good reason to be proud of our pipeage system, as well as the many other things about our works. We have no less than seven main lines running east and west, in sizes from 12 to 36 inches, which are supplied from the two 42-inch mains leading out from Pumping Works, and in addition to these lines mentioned are numerous lines of 8 and 10-inch pipe.

It will be seen by the table of pipeage that about four miles of our smaller lines of pipe have been discontinued or taken up, to give place to pipe of larger size, and where we find the condition of the pipe to warrant its relaying, we do so in such places where we have good reason to believe that only a moderate supply will be needed, and where the blocks are not lengthy.

We are also greatly improving our pipe system by shortening the dis ances between the stop-gates in older lines, by a more frequent placing of the said gates, thereby giving less annoyance to the fewer number, when for any cause it becomes necessary to shut off.

RECOMMENDATIONS.

Should the petitions for extensions and the general work of this department not be as numerous the coming season as in the immediate past, I would respectfully recommend that the following lines may be laid for main feeders, and the replacing of smaller lines of pipe with pipe of larger size.

Appended are some of the locations:

Gratiot Avenue.—A 12-inch pipe from St. Aubin Avenue to Chene Street. This will connect with the 30-inch main in Chene Street, distance 1,325 feet.

Crawford Street.—A 10-inch pipe from the 24-inch main in North Boulevard to Caniff Road, distance 7,800 feet.

Oakland Avenue.—A 10-inch pipe from the 24-inch main in North Boulevard to the northerly city line, distance 9,000 feet.

Twelfth Street.—A 10-inch pipe from the 24-inch main in North Boulevard to the northerly city line, distance 5,500 feet.

The three last mentioned lines are for main feeders and to meet and cure the accumulation of dead ends of the numerous lines that are laid and are being laid in the streets and avenues east and west of Woodward Avenue in the new northerly section of our city.

Mt. Elliott Avenue.—A 10-inch pipe from Gratiot Avenue the old city line, distance 8,000 feet, replacing about the me length of 4-inch pipe.

Rivard Street.—An 8-inch pipe from Fourth to Sixth Streets, stance, 750 feet, replacing the same length of 4-inch pipe.

John R Street.—An 8-inch pipe from Piquette Avenue to orth Boulevard, distance 1,500 feet, and in said street from iami to Adams Avenue, distance 900 feet, replacing 650 feet 4-inch pipe.

Park Street.—An 8-inch pipe from Columbia to Peterboro treets, distance 3,000 feet, replacing 1,300 feet of 4-inch pipe.

Rivard Street.—An 8-inch pipe from Gratiot to Palmer venues, distance 9,700 feet, replacing 8,000 feet of 4-inch ipe. In my recommendations for last year I had recommend-d the laying of a 12-inch main in this street to be laid from ratiot Avenue to Watson Street, the purport of which was to eet the overdrawn lines in Gratiot Avenue and contiguous reets. This plan was, however, changed and the line was id in Gratiot Avenue believing we should gain better results, hich has proved to be the case.

Waterloo Street.—An 8-inch pipe from Mt. Elliott to Con-ord Avenue, distance 1,575 feet, replacing 900 feet of 4-inch ipe. This line is for a cross-feed which will be fed from the 0-inch main in Cleveland Street.

St. Antoine Street.—An 8-inch pipe from Gratiot Avenue to Elizabeth Street, distance 1,100 feet, replacing the same length f 4-inch pipe.

Twelfth Street.—An 8-inch pipe from River Street to Lafay-tte Avenue, distance 750 feet, replacing the same length of -inch pipe; also on said street, from Howard to Baker Streets, distance 1,475 feet, replacing the same length of 4-inch pipe.

Beaubien Street.—An 8-inch pipe from Gratiot Avenue to Watson Street, distance 4,050 feet, replacing the same length of 4-inch pipe.

Holden Avenue.—An 8-inch pipe from North Boulevard to Crawford Street, distance 3,500 feet, replacing 2,100 feet of -inch pipe.

McDougall Avenue.—An 8-inch pipe from Clinton to Gratiot Avenue, distance 4,500 feet.

Hastings Street.—An 8-inch pipe from Farnsworth Street to Warren Avenue, distance 500 feet; also in said street, from Piquette Avenue to North Boulevard, distance 1,500 feet, replacing 4-inch pipe.

Dubois Street.—An 8-inch pipe from Leland Street to north of Harper Avenue, distance 6,750 feet, replacing 6,000 feet of 4-inch pipe.

Beaufait Avenue.—An 8-inch pipe from 585 feet north of Jefferson to 282 feet north of St. Paul Avenue, distance 2,400 feet, replacing the same length of 4-inch pipe.

Bellevue Avenue.—An 8-inch pipe from Gratiot Avenue to Farnsworth Street, distance 2,100 feet, replacing the same length of 4-inch pipe.

John R Street.—A 6-inch pipe from Erskine to Brady Street, distance 1,050 feet.

Holden Avenue.—A 6-inch pipe from Cass Avenue to Crawford Street, distance 1,900 feet, replacing logs.

Jerome Avenue.—A 6-inch pipe from Milwaukee Avenue to North Boulevard, distance 450 feet, replacing 450 feet of 4-inch pipe.

Piquette Avenue.—A 6-inch pipe from Beaubien to Hastings Street, distance 1,125 feet, replacing 3-inch pipe.

Leib Street.—A 6-inch pipe from Jefferson to Monroe Avenue distance 1,550 feet, replacing 3 and 4-inch pipe.

Brush Street.—A 6-inch pipe from Benton to Brady Street, distance 900 feet.

Adair Street.—A 6-inch pipe from Jefferson Avenue to Guoin Street, distance 1,125 feet, replacing 4-inch pipe.

Walker Street.—A 6-inch pipe from Jefferson Avenue to Atwater Street, distance 1,200 feet, replacing 4-inch pipe.

Twenty-third Street.—A 6-inch pipe from Magnolia to Buchanan Street, distance 1,850 feet, replacing 3 and 4-inch pipe.

Twenty-fifth Street.—A 6-inch pipe from Baker to Howard Street, distance 1,650 feet, replacing 4-inch pipe; also in said eet from Michigan Avenue to E Street, distance 825 feet, lacing 750 feet of 4-inch pipe.

Wabash Avenue.—A 6 or 8-inch pipe from Grand River enue to Lake Shore R. R., distance 2,500 feet, replacing log e.

Seventeeth Street.—A 6-inch pipe from Poplar to Buchanan eets, distance 500 feet, replacing 4-inch pipe.

have, in addition to the above lines, recommended several eived from Mr. Tryon, secretary of the Fire Department, ich I herewith append:

The first calls for a line of pipe in Elizabeth Street from ss to Grand River Avenue, distance 435 feet. I see but one ection to this, and that is, it would necessitate the taking up the new brick pavement in Grand River Avenue. We ld, however, lay a 6 or 8-inch pipe in said street from Cass the north line of Grand River Avenue and leave the end d for a time.

The second calls for a large main in State street from Washton avenue to Cass street, distance 600 feet. This should a 10-inch pipe.

The third calls for larger pipe in Park place from Michigan mue to Grand River avenue. As the block between Michi avenue and State street is a short one, the better plan uld be to run from State to Clifford streets, distance 750 feet. is would connect with the new 10-inch in State street, old ich in Grand River avenue and to a proposed 10-inch which y be laid in Clifford street. This would be an 8-inch line.

The fourth calls for pipe in Bagley avenue from Cass to Park eets, distance 1,050 feet. I think this would be much better t by laying a line of 10-inch pipe in Clifford street from ashington to Adams avenues. This would not only meet gley avenue, but Middle street and Adams avenue. This l shorten the 150 feet and will be fed from the 12-inch in fford street and the 10-inch in Washington avenue.

The fifth call is for the replacing of the logs in Wabash enue. This has already been mentioned.

The sixth calls for pipe in Kirby, Warren and Forest avenues, from Grand River to Cass avenues. The total length is about 20,000 feet, and when laid in this way it will have no special feeders. A much better plan to meet this call would be the laying of a 10 or 12-inch pipe in Commonwealth avenue from the 30-inch main in Brigham street and connecting there to run northerly to Kirby avenue. This distance is about 3,200 feet. And in Kirby avenue, for a cross feeder, lay an 8 or 10-inch pipe from Grand River to Cass avenues, distance 7,800 feet. By laying in this way we have to contend with less pavement, old or new, and will have a much better supply of water and will take 9,000 feet less pipe, all crossings, whether large or small pipe, being connected to these lines and the dead ends cured.

The seventh calls for pipe in Piquette avenue from Lincoln avenue to Twelfth street, distance 1,650 feet. This can be better met by filling the gaps in Trumbull and Commonwealth avenues. This will only require the laying of 1,300 feet.

The eighth calls for pipe in Fort street, from Randolph to St. Antoine streets, distance 1,175 feet; Monroe avenue, from Farrar to St. Antoine streets, distance 1,500 feet, and in Macomb street, from Randolph to St. Antoine streets, distance 1,175 feet. If laid, 6 or 8-inch pipe will answer this call.

The ninth calls for a better supply of water in the vicinity of the D. & M. Junction. This can be met by laying a 10-inch pipe in St. Aubin avenue from Trombly avenue to Pallister road. This will have a direct connection and feed from the 24-inch main in the N. Boulevard, distance 2,250 feet.

The above lines would take about 21 miles of pipe. This is a large amount, and may not be laid the coming season, should it be complied with; and yet not one of the lines mentioned but that should be laid in the very near future.

I am sorry to learn that the Detroit Pipe Foundry has closed its works and possibly may not resume operations again. Our dealings with this firm have been very satisfactory, and the foundry being in our city, it has given us a better opportunity of examining and testing the pipe before delivery by our inspector; and when any changes in our Works have made it sary to change the size of our pipe, this has been complied in a very prompt manner. The closing of the said foundry re our season's work was done has been the cause of some in closing up our work for the year, having had to com- our orders for pipe outside of our city.

ake the liberty of placing before the readers of our annual ts a few facts which, I think, may be of special interest to . They are the following: At the close of the year 1877, ncluding the work of that year, we had in connection with Vorks 104 miles of iron pipe and $89\frac{3520}{5280}$ miles of log pipe. he close of the year just passed, it will be seen by the s of pipeage we have now $426\frac{1939}{5280}$ miles of iron pipe and $5\frac{879}{5280}$ miles of log pipe, which has quadrupled our iron and lessened the log pipe eighteen fold, and increased the l size of pipe per mileage of all sizes above 4 inches $4\frac{1}{3}$ s greater, or 433 per cent., the greater percentage of which been for the replacing of logs, 3 and 4-inch pipe and in y of the streets in which no pipe had been laid in the busi- portions of our city, either for better fire protection or a bountiful supply of water for manufacturing purposes.

PIPEAGE.

The amount of distribution pipe and mains laid and relaid, and iron and wood pipe discontinued during the past season, is as follows: Total iron pipe laid and relaid $37\frac{2924}{5280}$ miles, of which 1,495 feet was relaid, and 1,575 feet was laid for private use; $3\frac{1653}{5280}$ miles of wood and $4\frac{448}{5280}$ miles of iron pipe were discontinued, making the net increase of the pipeage $29\frac{3939}{5280}$ miles. This amount added to the measured lines of iron and wood pipe connected with the Works, will make the total length $431\frac{2819}{5280}$ miles, of which $426\frac{1939}{5280}$ miles are iron and $5\frac{879}{5280}$ miles are wood pipe, which in detail is as follows:

Size of Pipe in Inches.	Measured Length in Feet, for 1891.	Added Length in Feet, 1892.	Discontinued Length in Feet, 1892.	Total Length in Feet For 1892.
45	103	......	......	103
42	44,909	......	......	44,909
36	715	......	......	715
30	49,337	......	.....	49,337
24	73,278	1,896	......	75,174
20	461	......	......	461
18	87	......	......	87
16	26,101	6,218	......	32,319
12	3,527	3,071	......	6,598
10	96,423	7,836	......	104,259
8	189,169	28,985	59	218,095
6	713,339	94,037	1,805	805,571
4	793,543	52,175	13,312	832,406
3	83,940	812	6,387	78,365
2	2,636	184	......	2,820
Total..	2,077,568	195,214	21,563	2,251,219

WARD	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	[illegible] In.	Lamp.	Lead	Totals.	[illegible]	[illegible]
First Ward	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Second "	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]					[illegible]			[illegible]	[illegible]	[illegible]
Third	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]		[illegible]			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Fourth	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]					[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Fifth	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Sixth	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]					[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Seventh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Eighth	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ninth	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Tenth	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]					[illegible]			[illegible]	[illegible]	[illegible]
Eleventh	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]			[illegible]			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Twelfth	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]			[illegible]	[illegible]	[illegible]
Thirteenth	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]		[illegible]			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
Fourteenth	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]					[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Fifteenth	[illegible]	[illegible]	[illegible]	[illegible]								[illegible]					[illegible]	[illegible]		[illegible]
Sixteenth	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]									[illegible]			[illegible]	[illegible]	[illegible]
Seventeenth	[illegible]	[illegible]	[illegible]	[illegible]								[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]
Outside of city line	[illegible]	[illegible]	[illegible]															[illegible]		[illegible]
Totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

During the past year, 739 gates have been set, and 70 re-set; 149 gates were taken out; of the 739 gates set 121 were for blow-offs, 32 were new and 89 old gates. Of the 70 re-set 60 were blow-offs, and of the 149 gates taken out 62 were blow-offs; the balance were replaced with gates of larger size on lines where the small pipe had been replaced with larger lines.

NEW GATES.

No. of Each Kind.	Name of Gate.	Size.	Remarks.
6	Murdock Valve Co..............	16	Set.
5	" " "...............	12	"
20	" " "...............	10	"
71	" " "...............	8	"
249	" " "...............	6	"
217	" " "...............	4	"
4	" " "...............	3	"
1	" " "...............	8	Blow-off.
5	" " "...............	6	" "
34	" " "...............	4	" "
1	" " "...............	3	" "
3	" " "...............	8 Auto.	Relief.
1	" " "...............	8 Flange.	"

OLD GATES.

No. of Each Kind.	Name of Gate.	Size.	Remarks.
2	Pittsburgh......................	24	Re-set.
2	Flowers Bros.....................	4	"
3	Murdock Valve Co.............	4	"
83	" " "...............	4	Blow off.
16	Galvin..........................	4	" "
15	Ludlow	4	" "
4	Pittsburgh......................	4	" "
31	Flowers Bros.....................	4	" "

There are now 4,374 stop-gates in use in the mains, and distribution pipes, ranging in size from 3 to 42 inches, and averaging 1 in 515 feet of pipe. In addition to this number e have 611 blow-gates, in sizes from 3 to 24 inches. These re not all located at dead ends, but are set at points on our ains, where flushing at times becomes necessary.

The appended table gives the length of 3, 4 and 6-inch pipe, nd logs which have been replaced with pipe of larger size, in etail, as follows:

SIZE OF PIPE LAID.	SIZE OF PIPE AND LOGS REPLACED.	LENGTH OF PIPE LAID.
-inch iron pipe.........	Log pipe................	8,479 feet.
“ “ “	3-inch iron pipe.........	714 “
“ “ “	Log pipe................	4,240 “
“ “ “	3-inch iron pipe.........	3.389 “
“ “ “	4 “ “ “	4,616 “
“ “ “	Log pipe................	3,839 “
“ “ “	3-inch iron pipe.........	1,130 “
“ “ “	4 “ “ “	4,351 “
“ “ “	6 “ “ “	84 “
“ “ “	Log pipe................	375 “
“ “ “	3-inch iron pipe..........	650 “
“ “ “	4 “ “ “	682 “
“ “ “	6 “ “ “	519 “
TOTAL...	....	33,068 “

There were connected with the water mains 324 hydrants nd 40 reservoirs, making the total number now in use 2,292 ydrants and 479 reservoirs. One hundred and eighty-six ranches were set for the fire department and 433 street ranches, ranging in size from 4 to 24 inches.

TABLE OF SERVICE CONNECTIONS.

Number of taps with iron and wood pipe of sizes from ⅝ inches to 6 inches, in detail as follows :

Size of Connection.	No. in 1891.	Added in 1892.	Discontinued 1892.	Total January 1, 1893.
Cast iron, 6-inch diameter	3	......	.....	**3**
" " 4 " "	57	6	......	**63**
" " 3 " "	82	16	......	**98**
" " 2 " "	84	18	......	**102**
" " 1 " "	8,136	993	......	**9,129**
" " ⅝ " "	30,082	2,521	......	**32,603**
Wood pipe	3,955	22	664	**3,313**
Mixed sizes	1,307	......	......	**1,307**
Grand total	44,706	3,576	664	**46,618**

	WARDS.																Totals
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	
New connections, iron pipes, ⅝ inch..................	54	31	89	43	116	77	105	120	426	124	201	162	198	152	337	286	2,521
New connections, iron pipes, 1 inch....................	114	81	68	109	51	65	31	57	37	128	34	36	28	22	98	34	993
New connections, iron pipes, 2 inches.................	3	3	3	.....	.....	2	.....	.....	.....	.....	1	1	.....	3	1	1	18
New connections iron pipes, 3 inches................	5	2	....	3	.....	.....	.....	2	1	.....	.....	.....	2	.....	.....	1	16
New connections, iron pipes, 4 inches......	3	1	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	6
New connections, log pipes, ⅝ inch.....................	.....	.....	5	1	.....	.....	1	.....	6	1	4	1	1	....	1	...	21
New connections, log pipes, 1 inch.............	1	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
TOTALS	179	118	165	156	167	145	137	180	470	253	240	200	229	178	437	322	3,576
Discontinued log connections ⅜ inch..............	9	6	56	6	64	28	4	31	288	9	80	23	1	.....	.....	2	607
Discontinued log connections, 1 inch............	3	5	3	19	2	11	....	.....	11	.....	2	.....	.....	1	....	.....	57
TOTALS..................	12	11	59	25	66	39	4	31	299	9	82	23	1	1	.....	2	664

REPAIRS DEPARTMENT.

This department of the Works has received its usual prompt attention in the many items of work coming under its care. Three thousand five hundred and seventy-six taps were made with the distribution pipes of sizes from five-eighths to four inches.

During the past year, this department has lost its chief foreman in the person of Mr. T. Shaughnessey, who was taken from our ranks by death. He had been in the employ of the Works for over twenty years, and had proved a very valuable officer.

This vacancy has been filled by Mr. John Wallace, who was one of our inspectors. He is filling the position with much credit to himself and the Works. Mr. Wallace's employment with the Works has been of long standing, having had considerable experience in this department.

I am glad to say no very serious breaks have occurred in our large mains the past season. It is true, however, that we have had to take out a defective branch in one of our 42-inch mains at the Pumping Works. This was an abandoned branch, the **T** end being defective. This was taken out and a straight piece inserted and sleeved up.

PUMPING WORKS.

To facilitate the better working of the engines at the Pumping Works, a 20-inch globe regulator valve was inserted in the 30-inch branch line connecting the two lines of 42-inch mains and the stand-pipe. Prior to this, the adjustment of the engines and mains was made by a partial closing of the 30-inch stop-gate on this branch line, the discs of which being loose in the cages carrying them, kept up a continual rattle, and fears were had that the seats would become so defaced, that when needing a perfect shut-off between the mains and stand-pipe we should be unable to do so. It is very gratifying to know that by the placing of this regulator valve it has met our needs. An 8-inch automatic relief valve, with its adjuncts, was attached to this pipe when inserting the said valve.

gine and Boiler House Extension.—This combination of e and boiler house is being extended at the west end to room for the fourth engine and a battery of four boilers. extension of the engine house proper will give a more ıetrical appearance to the building. It will be remembered before this extension, the building had rather a lop-sided ırance, a similar extension having been built on the east ome years ago for the third engine. The original design ıe house was for two engines only, and when it should ne necessary to add a third engine an additional house d be built on the west half of the grounds. The interior e engine house proper will have a floor space of 12,937.5 The inside measures 69 x 187.5 feet.

rce Mains.—Plans and specifications have been made for and specials for the connecting of the new No. 4 engine our two lines of 42-inch mains. The arrangement of the for connecting said engine and mains is rather unique, rrangement being such that this engine can be run in con- n with, or independent of, either of the other three en- , and can be used jointly with either of the two mains or wise, and when a third main is added, the arrangement) such that it can be used in the same manner with this main also. The specials for this work are being made ıe Frontier Iron Works, and the 42-inch gates and check- , by the Murdock Valve Co.

nduits.—Plans and specifications have been made for a oot cylinder brick conduit. This conduit is to convey 'ater from the settling basin to the new No. 4 engine. ower or south end will connect with the west gate and trainer well of No. 1 effluent conduit. The upper or north vill connect direct to the suction pipe of said engine. work will be commenced as soon as the weather will per-

ssrs. Langley and Jayne have the contract for this work. ıox sluice-gate and specials for the same are being made ıe Russel Wheel & Foundry Co

Surface Inlet.—No extension was made to this inlet as was recommended. I think this may be delayed for some time, as I have reason to believe that with our three inlets we need not fear any very serious trouble from anchor ice. The combined area of the three equals 76 square feet or nearly 10 feet in diameter.

The laying of the No. 1 inlet pipe which was contracted for in 1891, but which was not quite finished at its close, has been completed the past year.

The plan which Mr. Case mentions in our last year's report, of spanning the settling basin with a wire net-work of strainers, is a good one, and one in which I fully accord, and when I can give it the attention due to its merits, I shall make such plans as may meet this end.

In closing this report it is only courteous to say that the help in the office of my department has been very efficient and the co-operation with the other departments very harmonious.

Transmitted with this report are the locations of the pipes, mains and gates; also inventory of pipe, special castings and tools on hand to January 3, 1893.

Respectfully submitted,

HENRY BRIDGE,
Superintendent of Extension and Construction.

PIPEAGE OF THE CITY OF DETROIT,

TED BY STREETS, SHOWING THE KIND AND SIZE OF THE IRON AND WOOD PIPE NOW IN USE.

LOCATION.	DIAM. INCHES.	KIND.
Vinewood to Hubbard	4	iron.
rom Scotten 78 ft	4	"
., e. from Russell 349 ft	4	"
from Cass to Tenth	24	"
w. from Third 20 ft	6	"
alley s. of, from Cass to w. line of Lognon farm	4	"
alley s. of, crossing Sixth	6	"
alley n. of, from First to Twelfth	4	"
., from Gratiot to Center Line rd	6	"
rom 424 ft. s. of Wight to Jefferson	4	"
., from John R to Randolph	6	"
from Witherell to Hastings	4	"
alley s. of, from 240 ft. e. of Clifford to Cass	4	"
alley n. of, from Woodward to 100 ft. w. of Cass	4	"
t., from Woodward to Orleans	4	"
e. from Orleans 36 ft	18	"
from 36 ft. e. of Orleans to Gratiot	10	"
crossing Gratiot	8	"
., from Field to E. Boulevard	4	"
w. from Crane 215 ft	4	"
e ave., from Woodward to Cass	6	"
from Cass to Third	4	"
w. from Fourth 150 ft	3	"
e. from Crawford 430 ft	4	"
from Sixth to Seventh	4	"
from Seventh to alley w. of Trumbull	6	"
from alley w. of Trumbull to alley w. of Commonwealth	4	"
crossing Grand River	6	"
from Woodward to w. line of Brush farm	4	"
crossing Brush	4	"
w. from Beaubien 195 ft	4	"
from Beaubien to St. Antoine	3	"
from St. Antoine to Rivard	3	wood.
from Rivard to Russell	2¼	"
crossing St. Antoine and Hastings	4	iron.
from Russell to alley w. of Dubois	4	"
from alley w. of Dubois to Chene	3	"
from w. line of Chene to w. line of Grandy	4	"
crossing Grandy	3	"
from alley e. of McDougall to 401 ft. e. of Moran	4	"
from Woodward to Russell	4	"
from Russell to Orleans	3	"
from Orleans to Dubois	4	"
from 16-inch main to e. line of Woodward	6	"

LOCATION.	DIAM. INCHES.	KIND.
Alger ave., e. from Woodward 514 ft	4	iron.
Amherst st., w. from Junction 314 ft	4	"
Amsterdam st, crossing Woodward w. side and from e. to. w. line of Cass	4	"
Annexation st., e. from Junction 558 ft	4	"
Anthon st., w. from Junction 400 ft	4	"
Antietam st., from Rivard to 22 ft. w. of McDougall	4	"
Antoinette st., crossing Cass and Second	4	"
" e. from Second 165 ft	3	"
" w. from Twelfth 193 ft	4	"
" w. from Wabash 138 ft	4	"
" w. from Fourteenth 223 ft	4	"
" crossing Eighteenth, e. side	4	"
Arlington pl., from Woodward to Cass	4	"
Arndt st., from Gratiot to 275 ft. e. of Jos. Campau	2¼	wood.
" crossing Jos. Campau	4	iron.
" from 275 ft. e. of Jos. Campau to alley w. of McDougall	3	"
" from alley e. of McDougall to Elmwood	3	"
" from Elmwood to Mt. Elliott	4	"
Artillery ave., crossing River st. and Fort	6	"
" s. from Dix 477 ft	8	"
Ash st., from Grand River to alley e. of Trumbull	4	"
" from alley w. of Trumbull to National	3	wood.
" from Harrison to Twelfth	4	iron.
" from Twelfth to alley e. of Wabash	2¼	wood.
" w. from Wabash 148 ft	4	iron.
" crossing Fifteenth and Sixteenth	4	"
" from Sixteenth to Seventeenth	4	"
" from Seventeenth to Eighteenth	3	"
" crossing Eighteenth to alley w. of	4	"
" e. from Humboldt 166 ft	3	"
" from Humboldt to Sullivan	4	"
" w. from Sullivan 214 feet	3	"
" e. from Maybury 250 ft	4	"
" from e. line of Tillman to w. line of Twenty-fourth	4	"
" from Twenty-seventh to Vinewood	4	"
Atwater st., from Griswold to Shelby	3	"
" from Griswold to Bates	6	"
" from Randolph to 215 ft. e. of St. Aubin	4	"
" from 215 ft. e. of St. Aubin to McDougall	6	"
" alley s. of, from alley w. of Bates to Randolph	4	"
Audrain (in line with) from Clippert to Michigan Brass and Iron Works 1,808 ft	4	"
Aurelia st., w. from Twelfth 193 feet	4	"
Avery ave., crossing Grand River	6	"
" from alley s. of Lysander to 125 ft. n. of Putnam	6	"
" from Merrick to 345 ft. n. of Kirby	6	"
B st., w. from Vinewood 313 ft	4	"
Bagg st., from Woodward to Fifteenth	24	"
" from Fifth to Crawford	3	"
" crossing Crawford e. side	4	"
Bagley ave., from Park to Clifford	4	"
" alley e. of. from alley n. of Park to Cass	4	"
" alley w. of, from 230 ft. n. of Clifford to Grand River	4	"
Baker st., from Seventh to Twenty-fourth	8	"
" from Seventh to Eighth	4	"

LOCATION.	DIAM. INCHES.	KIND.
st., from Twenty-fourth to Vinewood	4	iron.
crossing Twenty-fifth and Vinewood e. side 29 ft	6	"
from Hubbard to Scotten	4	"
alley s. of, from Wabash to Fourteenth	4	"
n ave., from Jefferson to Kercheval	6	"
' from Mack to Warren	10	"
' from Gratiot to Center-line rd	8	"
ore ave., from Woodward to w. line of Crawford	4	"
" w. from Sullivan 297 ft	4	"
" crossing Brush w. side 38 ft	4	"
" from Woodward to w. line of Brush	3	"
st., from Atwater to Farmer	6	"
from Congress to Champlain	30	"
st., from Brush to 211 ft. e. of St. Antoine	4	"
len st., from Atwater to Clinton	6	"
' crossing Champlain	8	"
' from Clinton to Watson	4	"
' from Watson to Harper	10	"
' from Harper to s. line of n. Boulevard	6	"
' from s. line of n. Boulevard to n. line of same	10	"
it ave., n. from Jefferson 585 ft	6	"
' from 585 ft. n. of Jefferson to 282 ft. n. of St. Pau	4	"
' from 282 ft. n. of St. Paul to 263 n. of Kercheval	6	"
' from Mack to 295 ft. s. of Gratiot	6	"
' from Gratiot to 190 ft. n. of Forest	6	"
' crossing n. Boulevard	6	"
st., from Twenty-seventh to Vinewood	4	"
st., from First to Seventh	4	"
st., from Riopelle to St. Aubin	2¼	wood.
e. from St. Aubin 300 ft	4	iron.
w. from Dubois 100 ft	3	"
crossing Dubois and Chene	4	"
from Dubois to Grandy	3	"
from Grandy to Jos. Campau	2¼	wood.
e. from McDougall 402 ft	4	iron.
sle ave., from Parker to 250 ft. n. of Coe	6	"
ue ave., from Jefferson to s. line of Superior	6	"
crossing Gratiot	6	"
from Gratiot to 30 ft. s. of Farnsworth	4	"
crossing n. Boulevard	8	"
nt ave., from 16-in. main to e. line of Woodward	6	"
st., from Brush to Russell	4	"
st., from Gratiot to Jos. Campau	3	"
from Jos. Campau to alley w. of McDougall	2¼	wood.
crossing Joseph Campau and Elmwood	4	iron.
from alley e. of McDougall to Elmwood	3	"
from Ellery to Mt. Elliott	4	"
st., from Twenty-seventh to 190 ft. e. of Vinewood	4	"
ave., from 16-inch main to w. line of Woodward	6	"
w. from Woodward 1616 ft	4	"
st., crossing Collins	6	"
w. from Collins 314 ft	4	"
w. from Moran 284 ft	4	"
crossing E. Boulevard, e. side 31 ft	6	"
vard East, e. side, from 255 ft. s. of Jefferson to Congress	6	"
e. side, s. from Agnes 121 ft	6	"

LOCATION.	DIAM. INCHES.	KIND.
Boulevard East, w. side, from Jefferson ave. main to n. line	6	iron.
“ w. side, n. from St. Paul 52 ft	6	“
“ both sides, crossing Mack n. side	4	“
“ e. side, s. from Gratiot 29 ft	4	“
“ w. side, crossing Farnsworth and Ferry	8	“
“ e. side crossing Farnsworth and N Boulevard	6	“
“ w. side, crossing N. Boulevard	8	“
Boulevard North, n. side, crossing Frontenac	8	“
“ both sides, crossing Helen, Canton and Concord	6	“
“ both sides, crossing Bellevue, Beaufait and Meldrum	6	“
“ both sides, crossing Mt. Elliott, Ellery and Moran	6	“
“ both sides, crossing Collins	6	“
Boulevard East, both sides crossing Hendrie, Medbury and Piquette	6	“
“ e. side, crossing Harper, Boone and Kanter	6	“
Boulevard North, from Collins to Grand River	24	“
“ from Grand River to 14 ft. w. of w. Boulevard	16	“
“ s. side, from Woodward to 100 ft. e. of Rivard	4	“
“ n. side, crossing Woodward	6	“
“ n. side., e. from Grand River 600 ft	4	“
“ s. side, crossing Cass and Fourteenth	4	“
“ s. side, crossing Crawford, e. side	4	“
“ both sides crossing Eighteenth	4	“
“ s. side, from e. line to 361 ft. w. of Twelfth	4	“
“ s. side, from e. line of Grand River to e. side of W. Boulevard	4	“
Boulevard West, e. side s. from N. Boulevard 161 ft	4	“
“ w. side s. from N. Boulevard 117 feet	6	“
“ both sides crossing Buchanan	6	“
“ from alley e. of Twenty-seventh to Hubbard	6	“
“ from Myrtle to Michigan	6	“
“ w. side s. from Michigan 256 ft	4	“
“ from 327 ft. s. of Toledo to Dix	6	“
“ e. side from Dix to Baker	6	“
“ w. side from Baker to Shady Lane	3	“
“ both sides from Shady Lane to Fort	4	“
Bowen ave., from Jefferson to 177 ft. n. of Pontiac	6	“
Brady st., from Woodward to Beaubien	6	“
“ from Beaubien to Russell	4	“
Brainard st., from Cass to Third	4	“
“ from Third to alley w. of	2¼	wood.
“ from Fourth to alley w. of	4	iron.
“ from alley w. of Fourth to Crawford	3	“
“ from Sixth to Seventh	4	“
“ from e. line of Seventh to Trumbull	6	“
Brandon ave., from Hubbard to Junction	4	“
Bratshaw st., from Third to Fourth	2¼	wood.
Breckenridge st., w. from Fourteenth 140 ft	4	iron.
“ from 143 ft. e. of Seventeenth to Eighteenth	4	“
“ w. from Humboldt 74 ft	4	“
Brevoort pl., from alley w. of Eighteenth to Nineteenth	4	“
“ crossing Twenty-second	4	“
“ e. from Twenty-second 240 feet	2¼	wood.
Brewster st., from Brush to Russell	4	iron.
“ from Riopelle to Gratiot	4	“
Brigham st., from Third to Grand River	30	“
“ from Fourth to Eighth	4	“

LOCATION.	DIAM. INCHES.	KIND.
m st., crossing Lincoln and Twelfth	4	iron.
e. from Twelfth 196 ft	4	"
pl., from Twenty-first to Twenty-second	4	"
st., from Atwater to Jefferson	6	"
from Jefferson to Congress	4	"
from Congress to Gratiot	8	"
from Gratiot to Wilkins	4	"
from Edmund to Watson	24	"
from Watson to Benton	6	"
crossing Eliot and Rowena	4	"
from Alexandrine to 105 ft. s. of Piquette	6	"
from s. line of Piquette to 106 ft. n. of Trombly	6	"
s. from Baltimore 109 ft	6	"
n. from Baltimore 280 ft	3	"
from 280 ft. n. of Baltimore to 251 ft. n. of Milwaukee	4	"
from 251 ft. n. of Milwaukee to 24-inch main in N. Boulevard.	8	"
from Horton to Hamlin	4	"
crossing Chandler	6	"
st., w. from Twelfth 188 ft	4	"
ian st., from Grand River to Vinewood	30	"
from Vinewood to Livernois	16	"
from Wabash to Fifteenth	4	"
w. from Seventeenth 169 ft	4	"
from Eighteenth to 387 ft. w. of Humboldt	4	"
from 75 ft. e. of Sullivan to e. line of Maybury	3	"
from e. line of Maybury to Williams	4	"
from Twenty-third to w. line of Twenty-fourth	4	"
from Scotten to Twenty-eighth	4	"
alley s. of, from Joe to Howell	6	"
e pl., from Waterloo to Cleveland	8	"
r st., from Michigan to Julia	6	"
nut st., from Seventh to alley e. of Trumbull	4	"
from alley w. of Trumbull to National	4	"
e. from Wabash 263 ft	4	"
e. from Seventeenth 144 ft	4	"
from 227 ft. e. of Maybury to Williams	4	"
from Fifteenth to Twenty-fourth	24	"
rom Vinewood to Hubbard	4	"
c ave., from pumping works to Mack	42	"
crossing Jefferson to n. line	6	"
from 1,000 ft. n. to 2,050 ft. n. of Jefferson ave	6	"
c square, s. side, from Woodward to Randolph	24	"
n. side. from Monroe to Bates	6	"
alley n. of from alley w. of Bates to Randolph	4	"
m st., from Brush to Russell	4	"
w. from Riopelle 159 ft	4	"
from Dequindre to w. line of Chene	4	"
from w. line of Chene to Grandy	8	"
on ave., from 24 inch main to 132 ft. n. of N. Boulevard	6	"
from 132 ft. n. of N. Boulevard to Pallister	4	"
from Pallister to 23 ft. n. of Koch	6	"
u st., from River st. to Fort	6	"
n. from Dix 448 ft	4	"
oell ave., from River st. to Driggs	6	"
from 324 ft. s. of Fort to Celeron	6	"
from s. line of Dix to 62 ft. n. of McMillan	6	"

LOCATION.	DIAM. INCHES.	KIND.
Campbell ave., from Romeyn to Dunn	6	iron.
" from Jackson to 161 ft. n. of Herbert	6	"
Canfield ave., from Woodward to Third	30	"
" from Woodward to Third	4	"
" from Fourth to Crawford	4	"
" from Sixth to e. line of Seventh	3	"
" crossing Seventh	4	"
" from Twelfth to 48 ft. e. of Thirteenth	3	"
" e. from Thirteenth 48 ft	4	"
" from Woodward to Collins	42	"
" from Woodward to 767 ft. w. of Mt. Elliott	6	"
" w. from Mt. Elliott 767 ft	4	"
" alley s. of, e. from Hastings 331 ft	3	"
" alley n. of, e. from Hastings 335 ft	3	"
" alley n. of, e. from Second 150 ft	3	"
Caniff ave., from 16-in. main to w. line Woodward	6	"
" w. from Woodward 27 ft	4	"
Canton ave., from Jefferson to 210 ft. n. of Kercheval	6	"
" crossing Mack	6	"
" s. from Gratiot 1,052 ft	6	"
" from 95 ft. s. of, to 118 ft. n. of Farnsworth	6	"
" crossing N. Boulevard	6	"
" s. from Piquette 266 ft	6	"
Caroline st., w. from Twelfth 192 ft	3 & 4	"
Cass st., from Woodbridge to Jefferson	8	"
" from Jefferson to Fort	24	"
" from alley n. of Michigan to Spencer	4	"
" alley w. of, from alley n. of Adams to 119 ft. s. of Gilman	4	"
" alley w. of, s. from Gilman 119 ft	3	"
Cass st. and ave., from Jefferson to Joy	10	"
Cass ave., from Joy to Alexandrine and crossing Canfield	8	"
" from Alexandrine to 118 ft. s. of D. & B. C. R. R	6	"
" from 118 ft. s. of D. & B. C. R. R. to Milwaukee	8	"
" from s. line of N. Boulevard to 24-in. main	8	"
" west side, crossing Forest and Putnam	4	"
" alley w. of, from Ledyard to Bagg	4	"
Catherine st., from Gratiot to Rivard	4	"
" crossing Rivard	6	"
" from Rivard to Dequindre	4	"
" from Dequindre to St. Aubin	3	"
" from St. Aubin to Elmwood	4	"
Cavalry ave., from 416 ft. s. of Cadet to n. line of Dix	6	"
" from n. line of Dix to Toledo	4	"
Celeron st., from Junction to 274 ft. w. of Campbell	4	"
Celia st., from Twelfth to Thirteenth	4	"
" from Thirteenth to Wabash	3	"
Center-Line rd., from Baldwin to Vandyke	6	"
Champlain st., from Randolph to St. Aubin	30	"
" from Randolph to alley e. of	4	"
" from St. Antoine to Orleans	4	"
" from Orleans to Elmwood	6	"
" from Elmwood to 250 ft w. of Lieb	4	"
" w. from Lieb 250 ft	3	"
" from Lieb to Field	4	"
" crossing E. Boulevard	6	"
" from Field to e. line of Baldwin	6	"

LOCATION.	DIAM. INCHES.	KIND.
st., w. from Crane 238 ft	4	iron.
alley n. of, from Brush to St. Antoine	4	"
e., from Woodward to w. line of Oakland	6	"
ve., from Holcomb to McClellan	4	"
from Sixth to Seventh	4	"
st., from Chene to e. line of Jos. Campau	4	"
from Jos. Campau to alley w. of McDougall	3	"
from alley e. of McDougall to Elmwood	4	"
from Ellery to Mt. Elliott	4	"
w. from Concord 142 ft	4	"
ve., from Woodward to alley e. of Third	4	"
w. from Fourth 131 ft	3	"
e. from Fifth 180 ft	4	"
rom alley e. of Russell to e. line of Riopelle	3	"
rossing Russell e. side and Riopelle w. side	4	"
rom Congress to Canfield	30	"
rom Atwater to N. Boulevard (s. line)	6	"
from Grand River to alley w. of Trumbull.	4	"
from alley w. of Trumbull to National	3	"
from Harrison to Twelfth	4	"
., from Russell to Elmwood	4	"
., from alley w. of Eighteenth to Nineteenth	4	"
from Grand River 167 ft	4	"
st., e. from Lansing 134 ft	4	"
crossing Tenth to 170 ft. w	4	"
crossing Eleventh	4	"
alley s. of, from Eighth to Tenth	4	"
ve., from 16 in. main to w. line of Woodward	6	"
w. from Woodward 1,275 ft	4	"
from River st. to Fort	8	"
from 1,000 ft. n. of Fort to s. line of M. C. R. R	8	"
from s. line of M. C. R. R. to Michigan	6	"
from Mich. Pen. Car Wks to Michigan	4	"
in car works' grounds	6	"
w. from Scotten 292 ft	4	"
e. from Clark ave. 282 ft	4	"
n. and s. from 4-in. pipe 607 ft	3	"
ve., from e. line of Woodward to Crawford	6	"
t., from St. Aubin to Elmwood	10	"
from Elmwood to Burlage pl	8	"
lace, crossing Crawford e. side	4	"
e. from Crawford 264 ft	3	"
alley n. of, crossing Crawford e. side	4	"
alley n. of, from Crawford to alley w. of Fourth	3	"
from e. line of Woodward to Washington	12	"
from alley w. of Griswold to e. line of Washington	4	"
from Park pl. to Sproat	4	"
from Gratiot to Rivard	10	"
from Rivard to Orleans	16	"
nd ave., from Orleans to Elmwood	8	"
w. from Crane 211 ft	4	"
, n. from Dennis 481 ft	4	"
om Van Dyke to Belle Isle	6	"
crossing Russell e. side	4	"
from Gratiot to Canfield	42	"
from Canfield to Griffin	30	"

LOCATION.	DIAM. INCHES.	KIND.
st., crossing Twelfth st	4	iron.
from Twelfth to Thirteenth	3	"
from Foundry to Twenty-second	4	"
from Twenty-third to Twenty-fourth	4	"
, crossing Collins e. side	6	"
from e. line of Collins to 338 ft. e. of Moran	4	"
rt st., from Woodward to Cass	4	"
lace, s. from Theodore 260 ft	2¼	wood.
t., from Livernois to Clippert	4	iron.
re st., from Woodbridge to Jefferson	6	"
w. side from Jay to Waterloo	4	"
e. side from Waterloo to Gratiot	4	"
s. from Adelaide 206 ft	4	"
from Alfred to Pierce	4	"
from Canfield to Willis	4	"
court, n. from Hancock 12 ft	4	"
from 12 ft. n. of Hancock to 270 ft. n.	8	"
st., from Brush to St. Aubin	4	"
., crossing Twenty-third	6	"
from Twenty-fourth to Artillery	10	"
ave., n. from River st. 563 ft	6	"
from s. line of Fort to n. line of Dix	6	"
ve., from Junction to Campbell	4	"
k st., from Swain to Lady's lane	4	"
st., from Atwater to Clinton	6	"
from Clinton to Hunt	8	"
from Hunt to n. line of Leland	6	"
from n. line of Leland to Canfield	3	"
from Canfield to 188 ft. n. of Frederick	4	"
from 188 ft. n. of Frederick to Ferry	6	"
from Ferry to 338 ft. n. of Palmer	4	"
from 100 ft. s. of Medbury to 20 ft. s. of Harper	4	"
from 20 ft. s. of Harper to 102 ft. n. of Piquette	8	"
crossing N. Boulevard,	8	"
st. from Woodward to Cass	4	"
er ave., e from Crane 297 ft	4	"
., from Campbell to Wesson	6	"
r. from Vinewood 416 ft	4	"
rom Twenty-sixth to e. line of W. Boulevard	4	"
d pl., from Woodward to Brush	24	"
st., from River st. to alley s. of Fort	4	"
from Fort to alley n. of	2¼	wood.
from Baker to Cherry	4	iron.
from Grand River to Brigham	8	"
crossing Brigham s. 40 ft	6	"
from Brigham to Lysander	4	"
nth st., from Fort to 50 ft. n. of Linden	6	"
from 50 ft. n. of, to 370 ft. n. of Linden	3	"
from 370 ft. n. of, to 468 ft. n. of Linden	4	"
from 468 ft. n. of Linden to Buchanan	6	"
crossing Myrtle	8	"
from Buchanan to 369 ft. n. of Breckenridge	4	"
from Grand River to s. line of N. Boulevard	6	"
crossing N. Boulevard	8	"
n. of N. Boulevard 228 ft	6	"
alley w. of, from Brevoort to Webster pl.	4	"

LOCATION.	DIAM. INCHES.	KIND.
Eighteenth st., alley w. of, from St. Clair to Wing pl.	4	iron.
" alley w. of, from Chipman to Johnson	4	"
Eighteenth-and-a-half st., s. from River st. 504 ft.	3	"
" from River st. to Fort	4	"
Eleventh st., from Leverette to Michigan	6	"
Ellery st., from Arndt to Berlin	6	"
" from Mack to Pulford	6	"
" from Zender to Gratiot	6	"
" from s. to n. line of N. Boulevard	6	"
Ellery pl., from Forest to Hancock	3	"
Eliot st., from Woodward to Riopelle	4	"
Elizabeth st., both sides, from alley e. of Woodward to 200 ft. w. of Brush.	4	"
" from 200 ft. w. of Brush to Hastings	4	"
" alley s. of, from alley e. of Woodward to Witherell	3	"
Elm Grove ave., from Crane to Holcomb	4	"
Elm st., from Seventh to alley e. of Trumbull	4	"
" from alley w. of Trumbull to National	4	"
" from Harrison to alley e. of Wabash	4	"
Elmwood ave., from Jefferson to Monroe	4	"
" from Monroe to Maple	6	"
" from Waterloo to Hunt	4	"
" from Hunt to Gratiot	6	"
Endicott ave., crossing Woodward, e. side	4	"
Englewood ave., from 16-in. main to e. line of Woodward	6	"
" from e. line of Woodward to w. line of Oakland	4	"
Erskine st., from Woodward to Brush	4	"
Euclid ave., from 16-in. main to w. line of Woodward	6	"
Exposition Grounds, s. from River st. 948 ft	4	"
F st., w. from Vinewood 140 ft	4	"
Farmer st., from Bates to Gratiot	6	"
" from 15 ft. s. to 38 ft. n. of 30-inch main in Gratiot	8	"
Farnsworth st., from Woodward to Beaubien	6	"
" from Beaubien to Russell	4	wood.
" crossing Rivard 60 ft	6	iron.
" from Russell to Grandy	4	"
" from Mitchell to McDougall	4	"
" crossing Collins	6	"
" from Collins to Moran	3 & 4	"
" from Canton to Helen	4	"
" w. from Van Dyke 301 ft	4	"
" crossing E. Boulevard	6	"
Ferdinand st., n. from River st., 975 ft	4	"
" s. from Fort 480 ft	4	"
" from Porter to 140 ft. n. of Christiancy	6	"
" from 360 ft. s. to 309 ft. n. of Dix	6	"
Ferry ave., from Woodward to Russell	4	"
" from Russell to St. Aubin	8	"
" from St. Aubin to Mitchell	4	"
" from w. line to 12 ft. e. of Collins	8	"
" w. from Collins 60 ft	6	"
" w. from Moran 247 ft	4	"
" crossing E. Boulevard	8	"
" w. from Vandyke 263 ft	4	"
" alley s. of, from alley w. of St. Aubin w. 168 ft	2¼	wood.
Field ave., from Jefferson to 740 ft. n. of Waterloo	6	iron.
" from 4 ft. s. of Mack to 177 ft. n. of Medbury	6	"

LOCATION.	DIAM. INCHES.	KIND.
ave., from 16-inch main to w. line of Woodward	6	iron.
w. from Woodward 182 ft	4	"
st., from Congress to alley n. of	8	"
from alley s. of to alley n. of Lafayette	4	"
from Labrosse to alley n. of	4	"
from Michigan to Noble	4	"
both sides of Elton and Crawford parks	4	"
from Holden to 144 ft. s. of Piquette	4	"
nth st., from Fort to n. line of Grand River	6	"
from Bagg to Buchanan	24	"
n. from Warren 348 ft	6	"
from s. to n. line of N. Boulevard	6	"
st., from Front to Jefferson	6	"
from Jefferson to alley n. of and crossing Congress	8	"
from Woodbridge to Fort	4	"
from Fort to Grand River	6	"
alley e. of from alley n. of Michigan to Spencer	4	"
er ave., from Jefferson to 118 ft. n. of St. Paul	6	"
her st., w. from Wesson 238 ft	4	"
nce st., from Harper to Piquette	4	"
r st., n. from Forest 260 ft	3 & 4	"
t ave., from Woodward to Cass	4	"
both sides from Cass to Third	4	"
from Fourth to Seventh and crossing Trumbull	4	"
from Avery to 190 ft. w. of Twelfth	4	"
from Woodward to 324 ft. w. of Rivard	4	"
from Russell to 377 ft. e. of Chene	4	"
w. from Grandy 225 ft	2¼	wood.
crossing Collins	6	iron.
from Collins to Moran	4	"
from 124 ft. w. of Ellery to Mt. Elliott	4	"
w. from Beaufait 157 ft	4	"
w. from Baldwin 164 ft	4	"
alley n. of, from Orleans to alley e. of Riopelle	3 & 4	"
st., from Woodward to Griswold	4	"
from Woodward to Seventh	16	"
from Seventh to Fourteenth	6	"
from Fourteenth to Hoffman	8	"
from Hoffman to Twenty-fourth	6	"
from Twenty-fourth to w. line of Artillery	8	"
from St. Antoine to Meldrum	4	"
w. from Helen 168 ft	4	"
alley n. of, w. from Brush 135 ft	2¼	wood
alley n. of, from Brush to St. Antoine	4	iron.
dry st., from Baker to Michigan	6	"
th st., from Woodbridge to Larned	4	"
from Larned to Congress	8	"
from Fort to Grand River	6	"
th ave., from Grand River to Bagg	4	"
from Bagg to Brigham	6	"
from Brigham to Holden	4	"
alley w. of, from Brainard to alley n. of	4	"
alley w. of, from Selden to alley s. of	4	"
from 16-in. main to w. line of Woodward	6	"
teenth ave., from Fort to Lafayette	8	"
" w. side, n. from Porter 402 ft	4	"

LOCATION.	DIAM. INCHES.	KIND.
Fourteenth ave., from Lafayette to Bagg.	10	iron.
" from Bagg to Grand River	8	"
" from Grand River to s. line of N. Boulevard	6	"
" from s. to n. line of N. Boulevard	8	"
Fox st., from Frank to Alexandrine	3 & 4	"
Frank st.. from Fourth to 114 ft. w. of Sixth	4	"
" from 114 ft. w. of Sixth to alley e. of Seventh	3	"
Franklin st., from Randolph to Beaubien	4	"
" from Beaubien to Orleans	6	"
" from Orleans to 25 ft. e. of Dequindre	4	"
" from 25 ft. e. of Dequindre to McDougall	6	"
" from Walker to Adair	4	"
" crossing Lieb w. side	4	"
" w. from Lieb 310 ft	2¼	wood.
" alleys n. and s. of. from McDougall to Walker	4	iron.
Frederick st., from Woodward to 124 ft. e. of Riopelle	4	"
" from 252 ft. w. of St. Aubin to Jos. Campau	4	"
" crossing Collins	6	"
" from Helen to E. Boulevard	4	"
" from Baldwin to Van Dyke	4	"
Front st., from 170 ft. e. of First to Second	4	"
" e. from Third 107 ft	6	"
" alley n. of, from Second to Third	4	"
Frontenac ave., from 8-in. main to n. line of N. Boulevard	8	"
" s. from Medbury 93 ft	6	"
Gallagher pl., from Crawford to alley w. of Fourth	4	"
Garfield ave., from Woodward to w. line of Brush farm	4	"
" crossing Brush	4	"
" from 255 ft. w. of Beaubien to e. line of St. Antoine	4	"
" w. from Hastings 359 ft	3	"
" from Hastings to 47 e. of Chene	4	"
" from 47 ft. e. of Chene to Grandy	3	wood.
" crossing Grandy	4	iron.
" e. from McDougall 218 ft	4	"
" crossing Collins	6	"
" w. from Moran 213 ft	4	"
" w. from Beaufait 182 ft	4	"
" alley s. of, w. from Hastings 369 ft	4	"
Gilbert st., e. from Scotten 368 ft	4	"
Gilman st., from Cass to Grand River	4	"
Gladstone ave., from 16-inch main to 755 ft. w. of Woodward	6	"
" st., w. from Twenty-seventh 105 ft	4	"
" crossing Vinewood e. side	4	"
Glynn court, from 16-inch main to w. line Woodward	6	"
" w. from Woodward 300 ft	4	"
Goethe st., e. from McClellan 228 ft	4	"
Goldner ave., from Michigan ave. to G. T. Ry	6	"
Grand River ave., from Woodward to Cass	8	"
" from Cass to Third	6	"
" from Third to 400 ft. w. of Humboldt	8	"
" from 400 ft. w. of Humboldt to Vinewood	6	"
" from Vinewood to N. Boulevard	10	"
" from N. Boulevard to city limits	6	"
" from Brigham to Buchanan	30	"
" connecting 8-inch to 30-inch mains in Buchan an 22 ft.	8	"
" s. side, from Second to 56 ft. e. of Cherry	4	"

LOCATION.	DIAM. INCHES.	KIND.
ver ave., n. side e. from Eighth 110 ft	3	iron.
alley n. of, from 10 ft. w. of Bagley to alley w. of	4	“
alley n. of, from Fourth to Union	4	“
alley n. of, w. from Lincoln 47 ft	4	“
alley n. of, from 47 ft. w. of Lincoln to alley w. of	2¼	wood.
alley n. of, from Trumbull to alley w. of	6	iron.
ve., from Gratiot to Pierce	8	“
from Pierce to Harper	6	“
n. from Harper 322 ft	4	“
from 322 ft. n. of Harper to Chene	6	“
irt, n. from Warren 313 ft	4	“
crossing Twelfth w. side	4	“
from Twelfth to Thirteenth	3	“
pl., from Thirteenth to Wabash	3	“
crossing Wabash e. side	4	“
ve., from Woodward to Raynor	30	“
from Woodward to Brush	10	“
from Brush to 64 ft. w. of Sheridan	6	“
from 64 w. of Sheridan to 266 ft. w. of Butler	8	“
w. from Butler 266 ft	6	“
from 30 in main in Mullett to w. line of Rivard s	10	“
from w. line of Rivard s. to St. Aubin	12	“
., from Holden to Milwaukee	6	“
s. from 24 inch in N. Boulevard 87 ft	6	“
, e. from Mitchell 68 ft	4	“
st., from Detroit river to Atwater	3	“
from Atwater to State	6	“
s. from 12 in. main in Clifford 60 ft	10	“
., from Pallister to Whitaker	6	“
, from e. line Mullett farm to Orleans	4	“
from Orleans to 230 ft. e. of St. Aubin	3	“
from 230 ft. e. of St. Aubin to Dubois	4	“
from Chene to Joseph Campau	4	“
from Joseph Campau to Walker	6	“
e., from 16-in. main to e. line of Woodward	6	“
e. from Woodward 158 ft	4	“
crossing Riopelle	4	“
from Riopelle to w. line of St. Aubin	2¼	wood.
from w. line of, to 275 ft. e. of St. Aubin	4	iron.
w. from Dubois 162 ft	3	“
rom Dubois to Chene	4	“
rom Chene to Grandy	3	“
rom Grandy to Jos. Campau	2¼	wood.
ve., from Woodward to Oakland	4	iron.
d ave., from Toledo to s. line of L. S. R. R	6	“
from 356 ft. s. of Leavitt to 175 ft. n. of Ranspach	6	“
s. from Horatio 956 ft	6	“
ave., from w. line of Cass to 112 ft e. of Riopelle	4	“
from St. Aubin to Dubois	4	“
from 281 ft. w. of Chene to Grandy	4	“
from w. line of Mitchell to McDougall	4	“
crossing Collins	6	“
from e. line of Collins to Detloff court	4	“
from alley w. of Ellery pl. to alley w. of Mt. Elliott	4	“
e. from Van Dyke 255 ft	4	“
crossing Third	6	“

LOCATION.	DIAM. INCHES.	KIND.
st., from alley e. of McDougall to Elmwood	3	iron.
crossing Elmwood w. side 39 ft	4	"
from Elmwood to 70 feet of Ellery	6	"
, from Jefferson to Monroe and crossing Mack	6	"
from Gratiot to 132 ft. n. of Medbury	6	"
st., from St. Aubin to Dubois	3	"
from Dubois to alley w. of McDougall	4	"
from alley e. of McDougall to Elmwood	4	"
w. from Mt. Elliott 529 ft	4	"
ve., from Woodward to 550 ft. e. of John R	4	"
from 330 ft. west of, to e. line of Chene	4	"
from 408 ft. w. of, to e. line of Grandy	4	"
from Mitchell to e. line of McDougall	6	"
w. from Van Dyke 219 ft	4	"
from Woodward to Clifford	4	"
from Cass to Third	6	"
from alley e. of, to Third	4	"
t., from Scotten to 134 w. of Lovett	4	"
ve., from Jefferson to 202 ft. n. of Brinket	6	"
rom w. line of Third to Beaubien	4	"
rom Beaubien to w. line of A. Beaubien farm	3	"
rom w. line of A. Beaubien farm to Russell	4	"
rom Russell to Riopelle	3	"
rom Grand River to Third	6	"
rom w. line of Third to Fourth	3	"
rom Fourth to alley w. of Trumbull	4	"
rom alley w. of Trumbull to National	3	"
st., from River st. to Fort	8	"
ve., e. from Mt. Elliott 170 ft	4	"
ave., from 16-in. main to e. line of Woodward	6	"
ave., from Jefferson to Louis	6	"
from Elm Grove to alley s. of Mack	6	"
e., from Woodward to w. line of Second	6	"
from w. line of Second to Third	3	wood.
from Third to Fourth	4	iron.
from Fourth to Crawford	3	wood.
crossing Crawford	6	iron.
from Crawford to Commonwealth	4	"
s. from 24-in. main in N. Boulevard 95 ft	10	"
e., n. from Grand River 63 ft	4	"
w. from Eighteenth 596 ft	4	"
t., from Howell to Welch	6	"
from Welch to Livernois	4	"
e., from Woodward to Oakland	4	"
t., from Tenth to Twelfth	4	"
from M. C R. R. bridge to Twenty-fourth	6	"
from Twenty-fourth to Twenty-fifth	4	"
e. from Scotten 354 ft	4	"
w. from Junction 343 ft	4	"
, from alley s. of, to n. line of Buchanan	6	"
n. from Horatio 680 ft	6	"
ave., from Fort to 335 ft. n. of Brandon	6	"
from E. st. to Michigan	4	"
from Michigan to Myrtle	6	"
e., crossing Fourth w. side	4	"
from e. line of, to 564 ft. w. of Crawford	4	"
crossing Eighteenth	4	"

LOCATION.	DIAM. INCHES.	KIND.
Hudson ave., from w. line of, to 90 ft. e. of Humboldt	4	iron.
" from Maybury to Twenty-third	4	"
" e. from Twenty-fourth 119 ft.,	4	"
" from Twenty-sixth to e. line of Vinewood	4	"
Humboldt ave., from Michigan to s. line of D. & B. C. R. R	4	"
" crossing Butternut and Buchanan	6	"
" from 765 ft. s. of Grand River to McGraw	6	"
Hunt st., from Dubois to alley w. of McDougall	4	"
" from alley e. of McDougall to Elmwood	4	"
" from 15 ft. e. of Ellery to Mt. Elliott	4	"
Hurlbut ave., crossing Jefferson to 21 ft. n. of	6	"
Huron st., s. from Locust 295 ft	3	"
" from Locust to Bagg	2¼	wood.
Illinois st., from 212 ft. w. of Beaubien to Russell	6	iron.
" from Russell to St. Aubin	4	"
" from St. Aubin to Grandy	3	"
" crossing Dubois and Chene	4	"
" from Grandy to Jos. Campau	2¼	wood.
" e. from McDougall 241 ft	3	iron.
" from 241 ft. e. of, to 421 ft. e. of McDougall	4	"
" w. from Moran 193 ft	4	"
Indiana st., from Beaubien to Russell	3	wood.
" crossing St. Antoine, Hastings, Rivard and Russell	4	iron.
Ingersoll st., e. from Wesson 226 ft	4	"
Iron st., from Wight to Jefferson	6	"
Irving ave., from Auburndale to 473 ft. w. of Seventh	4	"
Irving st., from Crawford to Seventh	4	"
Ivy pl., s. from Grand River 418 ft	6	"
Jackson st., from e. line of Scotten to Twenty-ninth	4	"
" from Thirty-fourth to Thirty-fifth	6	"
Jay st., from Riopelle to 44 ft w. of McDougall	4	"
Jayne ave., n. from Mack 1,300 ft	6	"
Jefferson ave., from Griswold to Orleans	10	"
" from Second to Hastings	16	"
" from Dequindre to w. side of Belt line R. R	6	"
" from e. side of Belt line R. R. to McClellan	6	"
" from McClellan to e. city line	10	"
" e. from e. city line 741 ft	8	"
" from Meldrum to Pumping Works	42	"
" from Griswold to First	8	"
" alley s. of, from alley w. of Woodward to alley w. of Griswold	4	"
" alley s. of, from Shelby to Cass, and crossing Wayne	4	"
" alley s. of, from alley w. of Bates to Randolph	4	"
" alley s. of, from Brush to Beaubien	3	"
" alley s. of, e. from Beaubien 189 ft	4	"
" alley n. of, from alley w. of Bates to St. Antoine	4	"
" alley n. of, from alley e. of Griswold to First	4	"
" alley n. of, from First to Third	8	"
Jerome ave., n. from Piquette 473 ft	3	"
" from Milwaukee to s. line of N. Boulevard	4	"
" s. from 24-inch main in N. Boulevard 87 ft	6	"
Joe st., from Michigan to alley s. of Buchanan	6	"
John R st., from e. line of Woodward to Miami	12	"
" from Miami to Adams	4	"
" from Adams to Columbia	6	"

LOCATION.	DIAM. INCHES.	KIND.
st., from Columbia to Edmund	8	iron.
from Edmund to Erskine and crossing Eliot and Rowena	6	"
from Brady to Piquette	6	"
n. from Baltimore 250 ft	8	"
s. from Milwaukee 30 ft	6	"
crossing n. Boulevard	8	"
from alley s. of Custer to Hamlin	6	"
n st., from alley w. of Eighteenth to Nineteenth	4	"
st., from Cass to 160 ft. w. of Fifth	4	"
e. from Sixth 240 ft	3	"
mpau ave., from Atwater to Clinton	6	"
from Jay to s. line of Gratiot	6	"
from s. line of Gratiot to St. Joseph	4	"
from St. Joseph to 135 ft. s. of Hancock	6	"
from Theodore to Trombly	6	"
from Trombly to 250 ft. n. of Milwaukee	4	"
from 250 ft. n. of Milwaukee to s. line of N. Boulevard.	6	"
crossing N. Boulevard	8	"
from n. line of N. Boulevard to 238 ft. n. of Arthur	6	"
ine ave., from e. to w. line of Woodward	6	"
., from Cass to alley e. of Third	4	"
from Fourth to Fifth	4	"
H. st., from McClellan to Pennsylvania	4	"
on ave., from River st. to Driggs	6	"
from s. line of Wabash R. R. to s line of Fort	6	"
from s. line of Fort to Otis	8	"
r ave., crossing Collins and E. Boulevard e. side 31 ft	6	"
from 185 ft. w. of Collins to Moran	4	"
w. from Mt. Elliott 181 ft	4	"
w. from Van Dyke 208 ft	4	"
eval ave., from Mt. Elliott to Beaufait	4	"
from Field to Baldwin	4	"
ave., from 16-inch main to e. line of Woodward	6	"
an st., from Scotten to Twenty-eighth	4	"
ave., from Woodward to w. line of Cass	4	"
from 12 ft. e. to 180 ft. w. of Fourth	4	"
e. from Crawford 430 ft	3	"
from Crawford to w. line of Trumbull	4	"
from Commonwealth to Avery	4	"
from Harrison to 195 ft. w. of Twelfth	4	"
w. from Fourteenth 126 ft	4	"
from 87 ft. e. of Sixteenth to Eighteenth	4	"
crossing Humboldt and w. from Twenty-seventh 247 ft	4	"
crossing Brush and Woodward e. side 46 ft	6	"
crossing John R and Grandy	4	"
e. from Russell 216 ft	4	"
from St. Aubin to Chene	4	"
crossing Collins	6	"
e. from Helen 238 ft	4	"
ave., from 16-inch main to e. line of Woodward	6	"
from e. line of Woodward to w. line of Oakland	4	"
crossing Oakland w. side 26 ft	6	"
se st., from Fourth to Fifth	4	"
w. from Tenth 430 ft	3	"
from 430 ft. w. of Tenth to Twelfth	4	"
alley s. of, from Fourth to alley e. of Twelfth	4	"

LOCATION.	DIAM. INCHES.	KIND.
Labrosse st., alley n. of, from alley e. of Fifth to Eighth	4	iron.
" alley n. of, from Eighth to Tenth	3	"
Lady's lane., n. from Dry Dock st. 214 ft	4	"
Lafayette ave., from Griswold to Shelby	4	"
" w. from Tenth 743 ft	4	"
" from 743 ft. w. of Tenth to M. C. R. R. bridge	3	"
" from Twelfth to Fourteenth	4	"
" from w. line of Fourteenth to Fifteenth	3	"
" from Fifteenth to alley w. of Sixteenth	4	"
" w. from Seventeenth 106 ft	4	"
" from Twenty-second to alley e. of	4	"
" from e. line of Twenty-third to Twenty-fourth	4	"
" e. from Scotten 256 ft	4	"
" alley s. of, from Griswold to Shelby	6	"
" alley s. of, from Wayne to First	6	"
" alley s. of, from First to Fourth	4	"
" alley s. of, from Fifth to Tenth	4	"
" alley n. of, from Shelby to First	4	"
" alley n. of, from First to Tenth	6	"
" alley n. of, w. from Tenth 323 ft	4	"
" alley n. of, e. from Fourteenth 190 ft	3	"
Lafayette pl., e. from Scotten 364 ft	4	"
Lafferty st., from River st. to Fort	4	"
" from Fort to s. side M. C. R. R.	6	"
Lambie pl., e. from Twenty-second 240 ft	2¼	wood.
" crossing Twenty-second and Twenty-third, east side, 26 ft	4	iron.
Langley ave., from Fourth to 562 ft. w. of Crawford	4	"
Lanman st., crossing Vinewood, e. side	4	"
Lansing ave., from Fort to 159 ft. n. of Christiancy	6	"
" from 337 ft. s. of Dix to Toledo	6	"
Larned st., from Third to Hastings	16	"
" from Bates to Brush	4	"
" from St. Antoine to Dequindre	4	"
" from Riopelle to St. Aubin	12	"
" from St. Aubin to w. line of Elmwood	4	"
" from w. line of Elmwood to 748 ft. e. of	6	"
" crossing Lieb, e. side, and Mt. Elliott, w. side	4	"
" from Lieb to Mt. Elliott	2¼	wood.
" w. from Helen 156 ft	4	iron.
" from Woodward to alley w. of	8	"
" from Third to Fourth	8	"
" from Fourth to Fifth	4	"
La Salle ave., n. from Michigan 505 ft	6	"
" from n. line of G. T. R. R. to n. line of Buchanan	6	"
" from 359 ft. s. to 398 ft. n. of Hancock	6	"
" s. from McGraw 395 ft	6	"
Lauderdale ave., w. from Junction 272 ft	4	"
Laurel st., from Grand River to Wabash	4	"
Leavitt ave., from Wesson to Livernois	4	"
Ledyard st., from Cass to Third	6	"
Leib st., from Wight to Jefferson	6	"
" from Jefferson to Champlain	4	"
" from Champlain to Monroe	3	"
Leicester court, from 16 in. main to e. line of Woodward	6	"
" e. from Woodward 1,379 ft	4	"
Leland st., w. from Beaubien 206 ft	3	"

LOCATION.	DIAM. INCHES.	KIND.
from Beaubien to 21 ft. e. of Dequindre	4	iron.
from 21 ft. e. of Dequindre to McDougall	8	"
from McDougall to Collins	3	"
from 216 ft. w. of Moran to Gratiot	4	"
, n. from Forest 251 ft	3	"
e. from McClellan 158 ft	4	"
., from Seventh to Eighth and Tenth to Twelfth	4	"
alley s. of, from Eighth to Tenth	4	"
om Cass to Fourth	4	"
., from Grand River to alley n. of	4	"
crossing Brigham n. side 36 ft	8	"
from n. line of Brigham to 510 ft. n. of Holden	6	"
s. from 24 in. main in N. Boulevard 64 ft	6	"
alley w. of, from alley n. of Grand River to s. line of Brigham	4	"
alley west of, crossing Brigham s. side 16 ft	6	"
from Harrison to Eighteenth and crossing Humboldt	4	"
from alley w. of Humboldt to Maybury	4	"
from Tillman to Twenty-fourth	4	"
from Twenty-fifth to 26 ft. e. of Twenty-sixth	4	"
ve., from Dix to M. C. R. R	8	"
from M. C. R. R. to n. line of city limits	10	"
rom Grand River to Fourth	6	"
rom Fourth to alley e. of Trumbull	4	"
rom alley w. of Trumbull to 30 ft. e. of National	3	"
. from National 30 ft	4	"
rom Harrison to Wabash	4	"
from Crane to Company	4	"
from Crane to Holcomb	4	"
from Michigan to n. line of Buchanan	6	"
n. from Rich 912 ft	4	"
from 912 ft. n. of Rich to 264 ft. n. of Herbert	6	"
from Gratiot to Mt. Elliott	4	"
metery, in the grounds and w. from Mt. Elliott 650 ft	3	"
from Crystal to Orleans	4	"
., from Fourth to Crawford	3	"
crossing Sixth w. side	4	"
from Sixth to Seventh	3	"
from Seventh to Lincoln	4	"
from Avery to e. line of Thirteenth	4	"
t., w. from Twenty-seventh 340 ft	4	"
ve., from Jefferson to Marietta	6	"
from Marietta to Mack	8	"
from s. line of Mack to 144 ft. n. of Julia H	10	"
n. from Gratiot 299 ft	8	"
ave., from Atwater to Clinton	6	"
from Preston to Gratiot	8	"
from Gratiot to Canfield	4	"
from Canfield to 187 ft. n. of Garfield	6	"
from 187 ft. n. of Garfield to 301 ft. n. of	8	"
crossing Waterloo and Cleveland	8	"
s. from Hancock 76 ft	6	"
s. from Farnsworth 170 ft	6	"
from n. line of Hendrie to Palmer	6	"
alley w. of, from Mullett to Jay	4	"
alley w. of, from Cleveland to Hendricks	3	"

LOCATION.	DIAM. INCHES.	KIND.
McDougall ave., alley w. of, from Hendricks to Hunt.	4	iron.
" alley w. of, from Hunt to Charlevoix	3	"
" alley w. of, from Charlevoix to Arndt	3	wood.
" alley w. of, from Arndt to Berlin	4	iron.
" alley w. of, from Berlin to Heidelberg	2¼	wood.
" alley e. of, from Mullett to 88 ft. n. of Chestnut	4	iron.
" alley e. of, from Waterloo to Preston	3	"
" alley e. of, crossing Cleveland	4	"
McGraw ave., from Sixteenth to Sullivan	4	"
" e. from Winslow 76 ft	4	"
" from Grand River to Twenty-sixth	4	"
" from LaSalle to Scotten	4	"
McKinstry ave., from River st. to n. line of Toledo	6	"
McMillan st., w. from Junction 319 ft	4	"
" crossing Livernois e. side	4	"
Mack ave., from Gratiot to Cadillac	42	"
" from Gratiot to Townsend	4	"
" from Townsend to Baldwin and crossing Mt. Elliott	6	"
" w. from Helen 80 ft	6	"
" from Thorburn to 267 ft. e. of Parker	8	"
" from 659 ft. w. of, to 577 ft. w. of Jayne	8	"
" from 207 ft. w. of Jayne to 65 ft. e. of Crane s	8	"
" from McClellan to Pennsylvania	8	"
Macomb st., from St. Antoine to Elmwood	4	"
" alley s. of, from Brush to alley w. of	3	"
" alley s. of, from Brush to St. Antoine	4	"
" alley n. of, from Brush to alley w. of	3	"
" alley n. of, from Brush to St. Antoine	4	"
Madison ave., n. and s. sides from Witherell to John R	4	"
" from Randolph to St. Antoine	4	"
" alleys n. and s. of, from John R to Randolph	4	"
Magnolia st., from Harrison to Thirteenth	4	"
" from Thirteenth to Wabash	3	"
" from Fourteenth to Fifteenth	4	"
" from Eighteenth to Sullivan	3	"
" from Sullivan to Maybury	4	"
" crossing Humboldt and Twenty-fourth	4	"
" from Twenty-seventh to Vinewood	4	"
Mansur st., from Harper to 78 ft. s. of Piquette	4	"
Maple st., from Gratiot to Orleans	8	"
" from Orleans to St. Aubin	4	"
" crossing Dubois	8	"
" from St. Aubin to Elmwood	6	"
Marcy st., w. from Fourth 158 ft	3	"
" from 158 ft. w. of Fourth to Crawford	4	"
Marrietta st., e. from McClellan 521 ft	4	"
Mark st., w. from Twelfth 180 ft	4	"
Marston court from 16-inch main to e. line of Woodward	6	"
Martin pl. from Woodward to John R	4	"
Maybury ave., from Michigan to n. line of Ash	6	"
" from n. line of Ash to 34 ft. n. of G. T. Ry	8	"
" from 207 ft. s. of, to 173 ft. n. of Warren	8	"
" s. from Hudson 256 ft	8	"
Mechanic st., from Brush to Beaubien	4	"
Medbury ave., from Woodward to 350 ft. e. of John R	4	"
" w. from St. Aubin 730 ft	3	"

LOCATION.	DIAM. INCHES.	KIND.
ave., from w. line of St. Aubin to Jos. Campau	4	iron.
crossing E. Boulevard and Collins	6	"
w. from Collins 165 ft	4	"
from Helen to Frontenac	4	"
ave., from Jefferson to Congress	42	"
from Wight to 46 ft. n. of Fort	6	"
from 46 ft. n. of Fort to 360 ft. n. of Kercheval	4	"
from 360 ft. n. of, to 570 ft. n. of Kercheval	6	"
from Arndt to Gratiot and crossing N. Boulevard	6	"
ave., from Cass to Third	4	"
w. from Fourth 136 ft	4	"
from 136 ft. w. of Fourth to e. line of Crawford	3	"
from e. line of Crawford to Lincoln	4	"
from Trumbull to Twelfth	4	"
w. from Twelfth 214 ft	3	"
from 214 ft. w. of Twelfth to Wabash	3	wood.
w. from Seventeenth 182 ft	4	iron.
from Tillman to Twenty-third	4	"
from Twenty-seventh to Vinewood	4	"
ve., from Gratiot to Witherell	16	"
n. side from John R to Witherell	4	"
alley w. of, from Gratiot to alley s. of	6	"
alley w. of, from Gratiot to Witherell	4	"
alley e. of, from Randolph to John R	4	"
ave., from Woodward to Cass	24	"
from Washington to First	10	"
from First to Twenty-fourth	8	"
from Twenty-fourth to Livernois	6	"
s. side crossing W. Boulevard	6	"
alley s. of, from Shelby to Cass	4	"
private alley s. of, e. from Shelby 110 ft	3	"
alley n. of, from alley e. of Griswold to alley e. of Washington	4	"
alley n. of, from alley w. of Washington to alley w. of Cass	4	"
alley n. of, from First to alley e. of Second	4	"
ave., from River st. to 250 ft. n. of Wabash R. R.	6	"
from 62 ft. n. of Anthon to 157 ft. n. of McMillan	6	"
., from Sixth to Seventh	3	"
crossing Seventh	4	"
ee ave., from Beaubien to Green	6	"
from w. line of Avery to Twelfth	6	"
from e. line of Eighteenth to 36 ft. w. of Sullivan	4	"
from Beaubien to w. line of Riopelle	4	"
from Dubois to Chene	4	"
crossing Collins	8	"
., e. from Crane 336 ft	4	"
ve., from River st. to 582 ft. s. of Fort	6	"
from 582 ft. s. of, to Fort	4	"
ave., n. from Gratiot 265 ft	6	"
from 265 ft. n. of Gratiot to Canfield	4	"
from Canfield to Harper	6	"
n. from Harper 324 ft	4	"
from 324 ft. n. of Harper to 150 ft. s. of Trombly	6	"
from 150 ft. s. of Trombly to Griffin	4	"
st., e. from Russell 389 ft	4	"
st., crossing Vinewood	4	"

LOCATION.	DIAM. INCHES.	KIND.
Monroe ave., n. from Cadillac square 51 ft	6	iron.
“ from 51 ft. n. of Cadillac square to Farmer	4	“
“ from St. Antoine to Elmwood	4	“
“ from 216 ft. w. of, to 171 ft. e. of Lieb	4	“
“ w. from Helen 185 ft	4	“
“ from Crane to alley w. of	4	“
“ alley s. of, from alley n. of Cadillac square to Randolph	4	“
“ alley n. of, from alley e. of Woodward to Farmer	4	“
“ alley n. of, from Farmer to alley e. of Farrar	6	“
Montcalm st., w. from Woodward 412 ft	4	“
“ from 412 ft. w. of Woodward to Cass	3	“
“ from alley e. of Woodward to Brush	4	“
“ from Brush to St. Antoine	3	“
“ from St. Antoine to Hastings	6	“
“ from Hastings to Russell	3	“
“ alley s. of, w. from Beaubien 240 ft	2¼	wood.
Monteith st., crossing Vinewood, e. side	4	iron.
“ w. from Twenty-seventh 188 ft	4	“
Moran st., from Gratiot to Dane	6	“
Morrell st., from River st. to s. line of Christiancy	6	“
“ from 348 ft. s. of Dix to Toledo	6	“
Moross ave., s. from Gratiot 305 ft	6	“
Mott ave., from 16-in. main to e. line of Woodward	6	“
“ e. from Woodward 558 ft	4	“
Mt. Elliott ave., from 148 ft. s. of Wight to 285 ft. s. of Kercheval	6	“
“ from 285 ft. s. of Kercheval to Preston	8	“
“ from Preston to Mack	10	“
“ from Mack to Gratiot and crossing N. Boulevard	8	“
“ from Gratiot to 300 ft. n. of Griffin	4	“
Mullett st., from Gratiot to Chene	30	“
“ from St. Antoine to Elmwood	4	“
“ w. from Crane 211 ft	4	“
Mulberry st., from Twelfth to Thirteenth	4	“
Myrtle st., from Grand River to Hubbard	6	“
Nall ave., crossing Vinewood	6	“
Napoleon st., from Brush to Russell	4	“
National ave., from Michigan to Grand River	6	“
Newark st., from Nineteenth to Twentieth	6	“
“ e. from Foundry in Griffin's foundry yard	3	“
Newberry st., w. from Junction 341 ft	4	“
Newton ave., w. from Chene 1,264 ft	4	“
Nineteenth st., from Fort to Baker	4	“
“ from Baker to Newark	6	“
Noble st., w. from Fourth 150 ft	3	“
“ from 150 ft. w. of Fourth to Crawford	4	“
“ from Sixth to Seventh	4	“
Norton st., e. from Junction 386 ft	4	“
“ e. from Wesson 283 ft	4	“
Oakland ave., from 24 in. main to n. line of N. Boulevard	10	“
“ from Horton to Hamlin	6	“
“ from Marston to Koch and crossing Harmon	10	“
Orchard st., from First to e. side of Elton park	4	“
“ from w. side of Elton park to Sixth	4	“
“ from Sixth to Trumbull	6	“
Orleans st., from Atwater to Jefferson	10	“
“ from Jefferson to reservoir grounds	8	“

LOCATION.	DIAM. INCHES.	KIND.
leans st., from Congress to reservoir grounds	24	iron.
“ from reservoir to Scott	30	“
“ s. from Canfield 30 ft	30	“
“ crossing Leland s. side and from Alexandrine to Canfield	6	“
“ n. from Garfield 252 ft	4	“
“ from 252 ft. n. of Garfield to 195 ft. n. of Forest	6	“
“ from Trombly to Lyman	4	“
tawa st., e. from Thirteenth 180 ft	3	“
is st., e from Junction 303 ft	4	“
wen ave., from 16 in. main to 1,220 ft. e. of Woodward	6	“
allister ave., crossing Woodward	4	“
“ from Woodward to Oakland	3	wood.
“ from Oakland to 393 ft. e. of St. Aubin	6	iron.
“ north side, connecting 8-in. to 16-in. main in Woodward	8	“
almer ave., from Woodward to w. line of Brush farm	4	“
“ crossing Brush and Collins	6	“
“ from 126 ft. w. of Dubois to e. line of Grandy	4	“
“ crossing Russell and St. Aubin	4	“
“ e. from Moran 190 ft	4	“
“ from Mt. Elliott to 159 ft. e. of Meldrum	6	“
“ w. from Van Dyke 231 ft	4	“
ark ave, from Dix to Toledo	6	“
ark pl., from Michigan to s. line of State	4	“
ark st., from e. line of Woodward to Washington	16	“
“ from Woodward to alley s. of Columbia	6	“
“ from Henry to Peterboro	4	“
arker ave., n. from Mack 312 ft	6	“
arsons st., from Woodward to Cass	4	“
ennsylvania ave., n. from Jefferson 1076 ft	6	“
“ from Mack to Julia H	6	“
erry st., from Grand River to alley e. of Trumbull	4	“
“ from alley w. of Trumbull to National	4	“
“ alley s. of, from alley e. of Seventh to alley e. of Trumbull	4	“
“ from Humboldt to Eighteenth	4	“
eterboro st., from Woodward to Cass	4	“
ierce st., from Dequindre to Jos Campau	4	“
ine st., from Grand River to National	4	“
“ from National to Twelfth	3	“
“ crossing Twelfth, e. side	4	“
itcher st., from Cass to alley e. of Third	4	“
“ w. from Fourth 150 ft	3	“
“ from 150 ft. w. of Fourth to Crawford	4	“
“ from Sixth to Seventh	4	“
ingree ave., from Woodward to Crawford	6	“
iquette ave., from Woodward to Beaubien	4	“
“ from Beaubien to Hastings	3	“
“ from Hastings to Russell and crossing St. Aubin	4	“
“ from 466 ft. w. of, to e. line of Chene	4	“
“ e. from Florence 98 ft	4	“
“ crossing E. Boulevard and Collins	6	“
“ from E. Boulevard to Collins	4	“
“ e. from Moran 85 ft	4	“
“ w. from Mt. Elliott 326 ft	4	“
“ from Concord to Canton	4	“
“ crossing Crawford, e. side	4	“
“ from w. line of Avery to e. line of Twelfth	4	“

LOCATION.	DIAM. INCHES.	KIND.
Piquette ave., crossing Twelfth, e. side	6	iron.
" from Wabash to Fourteenth	4	"
" from Eighteenth to Sullivan	4	"
Pleasant ave., n. from River st. 515 ft	4	"
Plum st., from Second to alley e. of Trumbull	4	"
" from alley e. of, to Trumbull	6	"
Plumer st., from w. line of McKinstry to 283 ft. w. of Junction	4	"
" from Welch to Livernois	4	"
Poplar st., from 110 ft. e. of Wabash to w. line of Fifteenth	4	"
" crossing Thirteenth w. side	4	"
" e. from Maybury 376 ft	4	"
" from Tillman to 184 ft. w. from Twenty-third	4	"
" e. from Welch 289 ft	4	"
Porter st., w. from Twelfth 210 ft	3	"
" e. from Twelfth 200 ft	4	"
" from 210 ft. w. of Twelfth to Thirteenth	4	"
" crossing Fourteenth	4	"
" e. from Fourteenth 172 ft	3	"
" from Eighteenth to Nineteenth	4	"
" from Twentieth to Twenty-first	3	"
" w. from Twenty-first 150 ft	4	"
" from 150 ft. w. of Twenty-first to Twenty-second	3	"
" from Twenty-second to e. line of W. Boulevard	4	"
" from e. line of W. Boulevard to Vinewood	6	"
" from Hubbard to Scotten	3	"
" from McKinstry to Ferdinand	4	"
" alley s. of, from Thirteenth to alley e. of	3	"
Prentiss ave., from Cass to Third	4	"
Preston st., from McDougall to Mt. Elliott	4	"
Private st., (n. of Ferry) crossing Rivard	4	"
" w. from Rivard 362 ft	3	"
Private way (e. of Russell) s. from Pallister 405 ft	4	"
Pulford ave., from Gratiot to Mt. Elliott	4	"
" from Meldrum to Beaufait	4	"
Putnam ave., w. from Woodward 60 ft	6	"
" from 60 ft. w. of Woodward to w. line of Cass	4	"
" n. side, e. from Third 323 ft	4	"
" from Fourth to Lincoln	4	"
" from Trumbull to Twelfth	4	"
" w. from Twelfth 185 ft	3	"
" from Wabash to Fourteenth	4	"
Randall st., crossing Twenty-third w. side 26 ft	4	"
Randolph st., from alley s. of Atwater to Jefferson	4	"
" from Atwater to 24-in. main in Cadillac square	8	"
" from Larned to Congress	4	"
" from Congress to Adams	6	"
" crossing Gratiot	10	"
" alley w. of, n. from Atwater	3	"
" alley e. of, from alley s. of Fort to Champlain	4	"
" alley e. of, from alley n. of Monroe to Gratiot	4	"
Ranspach st., from Hammond to Livernois	4	"
Raynor st., from Clinton to Gratiot	4	"
Reed pl., w. from Fourth 36 ft	4	"
" from 36 ft. w. of Fourth to Crawford	3	"
" w. from Crawford 335 ft	4	"
Reeder ave., from Junction to 438 ft. w. of Campbell	4	"

LOCATION.	DIAM. INCHES.	KIND.
oir grounds, n. of basin to 30-in. branch	24	iron.
s. and w. sides of basin	24	"
t., e. from Vinewood 204 ft	4	"
from Scotten to Twenty-eighth	4	"
le st., from Atwater to Jefferson	8	"
from Jefferson to Larned	12	"
from Larned to Adelaide	8	"
from Adelaide to 218 ft. n. of Hancock	6	"
from Frederick to Kirby	6	"
alley e. of, s. from Canfield 218 ft	4	"
l st., from Atwater to Jefferson	8	"
from Larned to Congress	4	"
from Jefferson to Clinton	10	"
from Mullett to Gratiot	10	"
from Gratiot to Watson	4	"
from Eliot to 90 ft. s. of Warren	4	"
from 90 ft. s. of Warren to 10 ft. n. of Farnsworth	6	"
from 10 ft. n. of Farnsworth to 221 ft. n. of Palmer	4	"
from 221 ft. n. of, to 281 ft. n. of Palmer	6	"
crossing Medbury 126 ft	6	"
crossing Piquette	4	"
from 5 ft. s. of, to 153 ft. n. of N. Boulevard	6	"
from 153 ft. n. of N. Boulevard to Pallister	4	"
n. from Pallister 1,178 ft	6	"
st., from Third to Fourth	4	"
from Fifth to Sixth	4	"
from Sixth to e. side of M. C. R. R	8	"
crossing M. C. R. R. tracks 270 ft	6	"
from w. side M. C. R. R. to 525 ft. w. of Twenty-fourth	8	"
from Pleasant to Campau	8	"
from Campau to main entrance of Exposition Grounds	6	"
s. from main into Det. & L. S. Copper Wks	4	"
st., n. from Ferry 325 ft	4	"
ave., from Elm Grove to alley s. of Mack	6	"
m st., from Junction to Campbell	4	"
t., from Eighteenth to Twentieth	4	"
le ave., from 16 in. main to e. line of Woodward	6	"
from e. line of Woodward to w. line of Oakland	4	"
a st., from Woodward to Riopelle	4	"
nd st., s. from State 187 ft.	4	"
n. from State 237 ft	6	"
l st., from Larned to Congress n. line	6	"
from Congress to Monroe	8	"
from Mullett to Watson	8	"
from Watson to Canfield	6	"
from Canfield to s. line of Hendrie	10	"
from s. line of Hendrie to s. line of Piquette	8	"
from s. line of Piquette to Moeller	6	"
alley e. of, from Chase to Fort	4	"
alley e. of, n. from Willis 220 ft	4	"
nt st., crossing Collins	6	"
st., from Twenty-first to Twenty-second	4	"
from Twenty third to Twenty-fourth	4	"
r st., e. from McClellan 245 ft	4	"
der place, w. from Mt. Elliott 255 ft	4	"
t., from Orleans to Chene	30	"

LOCATION.	DIAM. INCHES.	KIND.
Scott st., from Riopelle ot e. line of St. Aubin	4	iron.
" from e. line of St. Aubin to Dubois	3	"
" crossing Dubois to 156 ft. e	4	"
" from 156 ft. e. of, Dubois to 499 ft. e. of Chene	3	"
" from 499 ft. e. of Chene to Joseph Campau	4	"
Scotten ave., from Fort to Dix	6	"
" from Dix to Buchanan	8	"
" from Buchanan to McGraw	6	"
" e. side from Buchanan s. to Buchanan n. 109 ft	16	"
Sears ave., from Holcomb to 169 ft. e. of McClellan	4	"
Second st., from Front to alley n. of Jefferson	6	"
" from Jefferson to alley n. of, and crossing Congress	10	"
" from Abbott to alley s. of	8	"
Second st. and ave., from Abbott to Bagg	10	"
Second ave., from High to 166 ft. n. of Henry	4	"
" from Bagg to 30 ft. n. of Prentiss	6	"
" crossing Canfield	8	"
" e. side, from s. line of Forest to 184 ft. n. of	6	"
" e. side, crossing Hancock, Warren and Putnam	6	"
" e. side, crossing Merrick, Kirby and Holden	6	"
" w. side, crossing Hancock, Warren and Putnam	4	"
" w. side, crossing Merrick, Kirby and Holden	4	"
" w. side, s. from Holden 700 ft	3	wood.
" from Holden to 205 ft. n. of Milwaukee	6	iron.
" crossing N. Boulevard	8	"
Second st., alley e. of, from alley n. of Michigan to Spencer	4	"
Second ave., alley e. of, from alley n. of Canfield to Prentiss	4	"
Selden ave., from Woodward to Third	4	"
" from Fourth to alley w. of	4	"
" from alley w. of Fourth to Crawford	3	"
" from Sixth to Seventh	4	"
Seventh st., from River st. to alley n. of Lafayette	8	"
" from alley n. of Lafayette to Bagg	10	"
" from Bagg to Grand River	8	"
" from Grand River to Brigham	6	"
" crossing Brigham	8	"
" from Brigham to n. line of Putnam and crossing Merrick	6	"
" from 214 ft. s. of Kirby to 339 ft. n. of Stanley	6	"
" alley w. of, from alley n. of Pine to Spruce	3	"
" alley w. of, from Perry to alley s. of	4	"
Seventeenth st., from Fort to 28 ft. s. of Poplar	6	"
" from 28 ft. s. of Poplar to s. line of Buchanan	4	"
" from s. line of Buchanan to 244 ft. n. of Hancock	6	"
" from Merrick to s. line of Stanley	6	"
" from s. to n. line of N. Boulevard	6	"
Shady Lane, crossing W. Boulevard	4	"
" crossing Vinewood	6	"
Shelby st., w. side from Atwater to Woodbridge	8	"
" w. side from Woodbridge to Jefferson	4	"
" e. side from Woodbridge to Jefferson	8	"
" from Jefferson to Michigan	10	"
" from Lafayette to alley s. of Michigan	4	"
Sheridan ave., from Jefferson to Kercheval	6	"
" from Mack to Gratiot	6	"
" from Gratiot to 18 ft. n. of Kirby	8	"
Sherman st., from Hastings to Elmwood	4	"

LOCATION.	DIAM. INCHES.	KIND.
erman st., from Crane to alley w. of	4	iron.
" n. side from Russell to Orleans	8	"
ley st., from Woodward to Clifford	4	"
ney ave., from 16.inch main in Woodward to w. line of Oakland	6	"
th st.. from River st. to Congress	16	"
" from Congress to Abbott	24	"
" from River st. to alley n. of	4	"
" from alley n. of Labrosse to Bagg	4	"
" n. from Bagg 88 ft	8	"
" from 88 ft. n. of Bagg to 473 ft. n. of Grand River	4	"
" from 478 ft. n. of Grand River to Brigham	6	"
" crossing Brigham	8	"
" from Brigham to 265 ft. n. of Lysander	4	"
teenth st., from Lafayette to Myrtle	6	"
" from Myrtle to Buchanan	8	"
" from Buchanan to Grand River	10	"
" from Grand River to McGraw	6	"
" s. from 24-inch main in N. Boulevard 63 ft	8	"
" alley w. of, from Lafayette to Howard	3	"
ith ave., from Woodward to Oakland	4	"
uth st., from Grand River to Noble	4	"
uthern ave., e. from Livernois 152 ft	4	"
encer st., from Cass to Second	4	"
roat st., from Woodward to Cass	4	"
ruce st., from Fifth to alley w. of Seventh	4	"
" from alley w. of Trumbull to National	4	"
" from Harrison to Twelfth	4	"
" alley s. of, from alley w. of Seventh to alley e. of Trumbull	3	"
. **Albertus pl.**, from 22 ft. e. of Dequindre to 260 ft. w. of St. Aubin	4	"
" w. from St. Aubin 260 ft	3	"
. **Antoine st.**, from Atwater to Congress	8	"
" from Jefferson to Congress	4	"
" from Congress to n. line of Gratiot	6	"
" crossing Champlain	8	"
" from Gratiot to Elizabeth	4	"
" from Elizabeth to Adelaide	6	"
" from Adelaide to Watson	8	"
" from Watson to Farnsworth and crossing Frederick	6	"
" n. from Piquette 445 ft	6	"
" from 150 ft. s. of Milwaukee to 4-in. in N. Boulevard	6	"
" crossing N. Boulevard	8	"
Aubin ave., from Atwater to n. line of Trombly	6	"
" from Pallister to 75 ft. n. of Vulcan	6	"
" from Congress to Champlain	36	"
" from Larned to Congress	12	"
" crossing N. Boulevard	10	"
" alley w. of, s. from Ferry 266 ft	2¼	wood.
Clair pl., from Nineteenth to alley w. of Eighteenth	4	iron.
Joseph st., from Russell to Riopelle	3	"
" from e. line of Riopelle to 310 ft. e. of St. Aubin	4	"
" from 310 ft. e. of St. Aubin to 202 ft. e. of Chene	3	"
" from 202 ft. e. of Chene to Grandy	4	"
" from Grandy to Jos. Campau	2¼	wood.
" from w. line of McDougall to 438 ft. e. of	3 & 4	iron.
Paul ave., from Bellevue to e. line of Concord	4	"
" crossing E. Boulevard	6	"

LOCATION.	DIAM. INCHES.	KIND.
St. Paul ave., from e. line of E. Boulevard to e. line of Field	4	iron.
“ from Townsend to Baldwin	4	“
“ from Crane to alley w. of	4	“
Standish st., from Twentieth to Foundry	6	“
Stanley ave., from Seventh to Commonwealth	4	“
“ crossing Crawford, Eighteenth and Humboldt	4	“
“ w. from Twelfth 183 ft	4	“
Stark ave., from Welch to Livernois	4	“
State st., from Woodward to Washington	30	“
“ from Woodward to Washington	10	“
“ w. of branch in Washington 24 ft	24	“
Stimson pl., from Woodward to Cass	4	“
Sullivan ave., from Michigan to 270 ft. n. of Linden	6	“
“ s. from Buchanan 288 ft	6	“
“ from 33 ft. n. of Stanley to 61 ft. n. of McGraw	6	“
“ from 104 ft. s. of Piquette to Baltimore	6	“
“ from s. to n. line of N. Boulevard	8	“
Summit ave., from River st. to Wabash R. R	6	“
Superior st., w. from Beaubien 220 ft. and crossing Brush	4	“
“ from Beaubien to Hastings	2¼	wood.
“ crossing St. Antoine, Hastings and Russell	4	iron.
“ e. from Hastings 359 ft	3	wood.
“ w. from Rivard 437 ft	4	iron.
“ from Rivard to Russell	2¼	wood.
“ from Riopelle to Dequindre	4	iron.
“ from Dequindre to St. Aubin	2¼	wood.
“ crossing Riopelle, St. Aubin and Chene	4	iron.
“ from St. Aubin to 343 ft. e. of Chene	3	“
“ from 343 ft. e. of Chene to Mitchell	4	“
“ McDougall to Gratiot	4	“
Swain ave., from 40 ft. s. of Wabash R. R. to Fort	6	“
Sycamore st., w. from Grand River 123 ft	6	“
“ from alley w. of Trumbull to National	4	“
“ from Harrison to Wabash	4	“
Sylvester st., from Gratiot to Mt. Elliott	4	“
“ from Beaufait to Concord	4	“
Tenth st., from River st. to Baker	8	“
“ from Baker to Michigan	6	“
Theodore st., e. from John R., 402 ft. and crossing Brush	4	“
“ from 226 ft. w. of Beaubien to 106 ft. e. of Riopelle	4	“
“ from 268 ft. w. of St. Aubin to Grandy	4	“
“ crossing Collins	6	“
“ e. from Moran 375 ft	4	“
“ from Mt. Elliott to w. line of Beaufait	4	“
Third st., from Front to s. line of River st	6	“
“ from s. line of River st., to Larned	8	“
“ from Larned to alley n. of	6	“
“ from Larned to Fort	24	“
“ from Abbott to High	6	“
Third ave., from Grand River to Bagg and crossing Brigham	8	“
“ from Bagg to Holden	6	“
“ from Brigham to Canfield	30	“
“ alley e. of, from Henry to Brainard	4	“
Thirteenth st., from Porter to 112 ft. n. of Elm and crossing Myrtle	6	“
“ from Magnolia to n. line of Grand River	6	“
“ n. from Grand River 499 ft	4	“

LOCATION.	DIAM. INCHES.	KIND.
nth st., s. from Hancock 80 ft	6	iron.
n. from Hancock 150 ft	4	“
from 150 n. of Hancock to 59 ft. n. of Warren	6	“
alley e. of, s. from Porter 121 ft	4	“
th st., from 30 ft. s. of Jackson to Buchanan	6	“
first st., from Michigan to 259 ft. s. of Warren	6	“
second st., from Michigan to 85 ft. n. of Buchanan	6	“
from 85 ft. n. of, to 358 ft. n. of Buchanan	8	“
third st., from Michigan to 462 ft. n. of Buchanan	6	“
fourth st., from 60 ft. s. of, to 136 ft. n. of Jackson	8	“
from 64 ft. s. of, to n. of Buchanan	8	“
fifth st., from Michigan to 192 ft. n. of Jackson and crossing Buchanan	6	“
from n. line of Buchanan to 223 ft. n. of Rich	8	“
rn ave., s. from Mack 1,628 ft	6	“
n ave., from Michigan to Breckenridge	6	“
s. from Warren 198 ft	6	“
from 360 ft. s. of, to 300 ft. n. of Merrick (on the w)	6	“
from Hudson to McGraw	6	“
ave., from 360 ft. e. of Scotten to McKinstry	4	“
from McKinstry to Livernois	6	“
st., crossing Scotten (w. side)	4	“
from Lovett to Twenty-eighth	4	“
end ave., from Jefferson to Kercheval	6	“
n. from Mack 208 ft	6	“
from 208 ft. n. of Mack to s. line of Gratiot	4	“
from s. line to 8-inch main in Gratiot	8	“
from 8 inch main in Gratiot to s. line of Ferry	6	“
ly ave., from Crystal to 7 ft. e. of St. Aubin	4	“
from Chene to 72 ft. e. of Ellery	4	“
from 72 ft. e. of Ellery to Mt. Elliott and crossing Collins.	6	“
ridge ave., from 16-inch main to e. line of Woodward	6	“
e. from Woodward 511 ft	4	“
ull ave., from Abbott to alley s. of	10	“
n. from Abbott 30 ft	6	“
from Michigan to Plum	6	“
from Grand River to alley n. of	6	“
from Brigham to Forest	8	“
from Forest to 497 ft. n. of G. T. Ry	6	“
from 50 ft. n. of Piquette to Holden.	6	“
alley e. of, from Plum to Sycamore	6	“
alley w. of, from Cherry to Pine	3	“
alley w. of, from Pine to Myrtle	4	“
alley w. of, from alley n. of Grand River to Brigham	6	“
s st., alley n. and s. of, from alley w. of Fourth to Crawford	4	“
h st., from 458 ft. s. of River st. to Lafayette	4	“
from Howard to Baker	4	“
from Baker to Brigham	6	“
from Brigham to s. line of N. Boulevard	8	“
from s. line of N. Boulevard to 24-inch main	10	“
200 ft. e. of, from Porter to alley n. of	4	“
leth st., from Fort to Michigan	6	“
alley e. of, s. from Rose 197 ft	3	“
y-first st., from Fort to Standish	4	.
y-second st., from Fort to Dalzelle	6	“
y-third st., from Fort to Magnolia	6	“

LOCATION.	DIAM. INCHES.	KIND.
Twenty-third st., from Magnolia to 35 ft. n. of Linden	3	iron.
" from 35 ft n. of Linden to L. S. R. R	4	"
" from 163 ft. s. of Buchanan to Warren	6	"
" from 278 ft. s. of Merrick to Kirby and crossing McGraw	6	"
" from Kirby to s. line of McGraw	4	"
Twenty-fourth st., from River st. to Fort	4	"
" from Fort to Baker	6	"
" from Baker to 20 ft. n. of Michigan	8	"
" from 20 ft. n. of, to 54 ft. n. of Michigan	12	"
" from 54 ft. n. of, to 96 ft. n. of Michigan	16	"
" from 96 ft. n. of, to 181 ft. n. of Michigan	18	"
" from 181 ft. n. of, to 236 ft. n. of Michigan	20	"
" from 236 ft. n. of Michigan to Butternut	24	"
" from Butternut to Buchanan	10	"
" from Buchanan to n. line of McGraw	8	"
Twenty-fifth st., from Howard to Baker	4	"
" from Baker to 100 ft. s. of Toledo	6	"
" from E st. to Michigan	4	"
" from Michigan to Linden	6	"
" n. from Linden 192 ft	3	"
" from 595 ft. s. of Buchanan to Hancock	6	"
" from 72 ft. s. of, to n. line of McGraw	6	"
Twenty-sixth st., from 213 ft. s. of E st. to Buchanan	6	"
" from 152 ft. s. of, to 421 ft. n. of Hancock	8	"
" from 410 ft. s. of Kirby to McGraw	6	"
Twenty-seventh st., from Myrtle to Monteith	6	"
" crossing Buchanan	8	"
" from Beaver to Warren	6	"
" from 94 ft. s. of Merrick to Hudson	6	"
Twenty-eighth st., from Michigan to 14 ft. n. of Rich	6	"
Twenty-ninth st., from 565 ft. s. of Michigan to Buchanan	6	"
Union st., from Fourth to Fifth	3	"
Uthes st., from Clark to McKinstry	4	"
Van Dyke ave., from Jefferson to 150 ft. n. of Waterloo	8	"
" from Mack to Gratiot n. line	8	"
" from Gratiot to Centre Line road	6	"
Vine st., from Fourth to Fifth	3	"
Vinewood ave., from Fort to Buchanan	24	"
" from Fort to 430 ft. n. of Toledo	6	"
" from F st. to Buchanan	6	"
" from Buchanan to Merrick	10	"
" s. from Grand River 300 ft	8	"
Visgar st., from Vinewood to La Salle and crossing Scotten e. side	6	"
" from Lovett to Twenty-eighth	6	"
Volunteer ave., w. from Junction 315 ft	4	"
" e. from Dragoon 123 ft	4	"
Wabash ave., from n. line of M. C. R. R. to Ottawa	6	"
" from Ottawa to s. line of Grand River	4	"
" crossing Grand River, Warren and N. Boulevard	6	"
" from n. line of Grand River to s. line of L. S. R. R	2¼	wood.
" from s. line of L. S. R. R. to 186 ft. n. of Piquette	6	iron.
" alley e. of, from 135 ft. s. of Butternut to Myrtle	2¼	wood.
" alley e. of crossing Myrtle	4	iron.
Walker st., from Atwater to Jefferson	4	"
Warren ave., from Second to Third	4	"

LOCATION.	DIAM. INCHES.	KIND.
ave., from Fourth to Crawford	2¼	wood.
from Crawford to 106 ft. w. of Seventh	4	iron.
from Avery to alley w. of Wabash	4	“
from Fourteenth to Sixteenth	4	“
from 69 ft. w. of Humboldt to 108 ft. w. of Vinewood	6	“
from e. line of Scotten to La Salle	6	“
from w. line of Cass to 105 ft. e. of Riopelle	4	“
from Warren court to Grandy	4	“
crossing Collins	6	“
e. from Helen 148 ft	4	“
court, from 181 ft. s. of, to 56 ft. n. of Warren ave	4	“
gton ave., from Michigan to State	30	“
from Michigan to Park	10	“
alley e. of, from alley n. of Michigan to alley s. of Park.	4	“
alley w. of, from alley n. of Michigan to alley s. of Park.	4	“
o st., from Dequindre to Jos. Campau	4	“
from Jos. Campau to alley e. of McDougall	6	“
alley e. of McDougall to Elmwood	4	“
e. from Elmwood 562 ft	3	“
from 562 ft. e. Elmwood to w. line of Burlage pl	4	“
from Burlage pl. to Mt. Elliott	8	“
from Mt. Elliott to 57 ft. e. of Beaufait	4	“
st., from Woodward to Brush	4	“
from Brush to Reservoir	24	“
from Dequindre to Chene	4	“
st., s. from Woodbridge 173 ft	4	“
from Woodbridge to Michigan	6	“
r pl., from alley w. of Eighteenth to Nineteenth	4	“
e. from Twenty-second 240 ft	2¼	wood.
ve., from Plumer to s. line of M. C. R. R	6	iron.
from 211 ft. s. of, to 309 ft. n. of Stark	6	“
from s. line of Ingersoll to n. line of city limits	6	“
ave., from Toledo to L. S. R. R	6	“
from n. line of G. T. Ry. to Leavitte	6	“
from D., L. & N. Ry. to 190 ft. n. of Herbert	6	“
n Hay Market, w. from Trumbull 171 ft	3	“
nster ave., from 16-in. main to 1222 ft. e. of Woodward	6	“
er ave., e. from Russell 779 ft	4	“
ave., e. from Jos. Campau 1880 ft	4	“
n pl., from Harper to 55 ft. n. of Piquette	6	“
t., from Chene to Leib	4	“
from Leib to 110 ft. e. of Meldrum	6	“
alley s. of, e. from McDougall 230 ft	4	“
st., from Woodward to Miami	12	“
ave., from 16-in. main to w. line of Woodward	6	“
from w. line of Woodward to e. line of Crawford	4	“
st., from Brush to Russell	4	“
from 158 ft. w. of Riopelle to Orleans	4	“
from Orleans to 30-in. main in Chene	8	“
s ave., from Michigan to 196 ft. n. of Breckenridge	6	“
from n. line of Merrick to Hudson	6	“
s rd., from 16-in. main to w. line of Woodward	6	“
ve., from Woodward to Beaubien	4	“
from Beaubien to St. Antoine	3	“
from St. Antoine to Hastings	2¼	wood.
e. from Hastings 356 ft	4	iron.

LOCATION.	DIAM. INCHES.	KIND.
Willis ave., from 356 ft. e. of Hastings to Rivard	3	iron.
“ from Rivard to the w. line of Russell	3	wood.
“ from the w. line of Russell to the e. line of Chene	4	iron.
“ from the e. line of Chene to Grandy	3	“
“ from Jos. Campau to w. line of McDougall	2¼	wood.
“ crossing Mitchell	4	iron.
“ from w. line of, to 291 ft. e. of McDougall	4	“
“ e. from Collins 146 ft	4	“
“ e. from Moran 984 ft	4	“
“ from Woodward to Third	6	“
“ from Fourth to Crawford	4	“
“ from Sixth to Eighth	4	“
“ e. from Twelfth 215 ft	3	wood.
“ crossing Twelfth	4	iron.
Winder st., from Woodward to Orleans	4	“
Wing place, from alley w. of Eighteenth to Nineteenth	4	“
Winslow ave. n. from Grand River 85 ft	4	“
“ from 85 ft. n. of Grand River to McGraw	6	“
Winter st., e from Dequindre 431 ft	4	“
Witherell st., from e. line of Woodward to Miami	16	“
“ from Woodward to Miami	6	“
“ from Miami to Adams	4	“
“ from Adams to alley n. of	3	“
Wolff st. e. from Scotten 357 ft	4	“
Woodbridge st., from Randolph to Brush	4	“
“ w. from St. Antoine 230 ft	3	“
“ from St. Antoine to Rivard	4	“
“ from Rivard to Russell	3	“
“ from Russell to Orleans	4	“
“ from Orleans to Dubois	6	“
“ w. from Joseph Campau 300 ft	2¼	wood.
“ e. from Joseph Campau 400 ft	4	iron.
“ crossing Leib w. side 24 ft	4	“
“ w. from Leib 300 ft	2¼	wood.
“ alley s. of, from Bates to Randolph	4	iron.
“ alley s. of, from Brush to 210 ft. e. of Beaubien	3	“
“ crossing Woodward	8	“
“ from Woodward to Griswold	6	“
“ from Griswold to First	4	“
“ from First to Second	6	“
Woodland ave., from 16-in. main to e. line of Woodward	6	“
“ e. from Woodward 780 ft	4	“
Woodward ave., from Atwater to Jefferson	16	“
“ (e. side) s. from Atwater 246 ft	3	“
“ (w. side) s. from Atwater 171 ft	4	“
“ from Jefferson to Soldiers' monument	24	“
“ from Atwater to Adams	8	“
“ from Adams to Baltimore	10	“
“ from Baltimore to Pallister	8	“
“ from N. Boulevard to Woodland	16	“
“ from High to 200 ft. n. of Canfield	4	“
“ from Bagg to Edmund place	24	“
“ alley e. of, from alley s. of Atwater to alley s. of Jefferson	4	“
“ alley e. of, from alley n. of Jefferson to alley n. of Congress	4	“

LOCATION.	DIAM. INCHES.	KIND.
odward ave., alley e. of, from alley s. of, to Gratiot	6	iron.
" alley e. of, n. from Gratiot 180 ft	8	"
" alley e. of, from 180 ft. n. of Gratiot to alley s. of Witherell	4	"
" alley e. of, from alley s. of, to Elizabeth	3	"
" alley e. of, crossing Elizabeth	4	"
" alley e. of, from Columbia to Montcalm	4	"
" alley w. of, from Atwater to alley s. of Jefferson	4	"
" alley w. of, from alley n. of Jefferson to Larned	4	"
" alley w. of, from Larned to Congress	8	"
" alley w. of, from Congress to alley n. of	4	"
" alley w. of, from alley n. of Michigan to alley s. of Park	4	"
" alley w of, from Montcalm to High	3	"
oodward ave. terrace, from Woodward to w. line of John R	4	"
reford ave., from Eighteenth to Grand River	4	"
nder place, w. from Mt. Elliott 854 ft	4	"

CITY OF DETROIT,
HEALTH OFFICE,
November 2d, 1892.

ANALYSIS OF DETROIT RIVER WATER.

Grains per Wine Gallon.

	S. P. Duffield, Ph.D., M.D.	A. B. Lyons, M.D.	S. P. Duffield, Ph.D., M.D.
	1861	1879	1892
otassic Chloride	.1445	....	....
odic Chloride	.3605	.229	.2289
odic Carbonate	.0000	.394	.3941
alcic Sulphate	2.5310	1.043	1.0430
alcic Carbonate	1.6518	3.353	3.3520
agnesic Chloride	.1847	....	....
agnesic Carbonate	....	1.209	1.2100
luminum Phosphate	.0344	....	....
lumina	.5926	.241	2.4500
errous Carbonate	.5080	Trace	*Strong trace
ilicic Anhydride	.2625	.306	.3060
Total	6.2700	6.775	6.7790

* Solids from one liter show iron distinctly.

Parts per Million.

Free Ammonia	Process not known in 1861.	.050	.02087
Albuminoid Ammonia		.125	.02500
Total Mineral Solids		115.160	115.22000
Volatile and Organic Matters	....	15.000	15.10000
Chlorine	....	2.100	2.10100

The first column gives my analysis made in 1861, before we had reached the fine estimation of Albuminoid Ammonia, the process not having been even dreamed of then. I cannot understand how Dr. Lyons' analysis shows so much Albuminoid Ammonia per million parts, as Prof. Prescott's and my analysis do not show anything like that amount. The season of the year and the condition of Lake St. Clair and its tributary streams will influence that greatly. Albuminoid Ammonia does not point to any sewage contamination necessarily, but should there be any suspicions that the water was receiving sewage, then it should be a guide as to the quantity. I think, coupled with estimations of chlorides, nitrates, nitrites, etc., that a pretty fair opinion can be formed of the water. Next year I will take water at different points in the river, and especially about the time of spring freshets. The water now is very pure, but we cannot say it will read as well when the spring storms come. I think that the typhoids which show themselves in our city must originate from either bad drainage, sewage or from bad water drunk outside our city.

Yours respectfully,

SAMUEL P. DUFFIELD, M.D.,
Health Officer.

ALYSES OF DETROIT ICE AND DRINKING WATER.*

BY J. E. CLARK, M. D.,

mistry and Physics, Detroit College of Medicine, and Professor of Chemistry
oxicology, Department of Pharmacy, Detroit College of Medicine.

nt to this society, for its
ight, the result of numer-
lucted by myself and as-
he past year, on the ice
of our city, for the pur-
ng, so far as the chemist
he healthfulness of the

been laborious but inter-
rust that, in giving it to
sults may be in some de-

f water are from samples
ants during the different
ar, and are not the result
ny analyses. The details
ialyses would be tedious
;, so I have confined my-
maximum and minimum
The mean can be readily
variation of the two ex-
002 parts per million of
d but .005 in albuminoid
g a remarkable constancy
ur water supply.
much, however, for our
majority of the samples
ome were evidently con-
wage. This is a matter
rol of the proper author-
receive the attention its
ads. Some of the samples
ied directly from dealers
drug stores, meat shops,
parts of the city.
supply is easily rendered
ring the months we are
kness, it is contaminated
urce.
es I sought for indications
iination, but with the ex-
mples of ice, I found no
ort such a theory. Recent
ve shown that the real danger to health lies not so much in the substances found by the chemist in his investigations, which are *per se* harmless, but in certain micro-organisms beyond the domain of purely chemical investigations, and it had become somewhat the fashion to lessen the importance attached to a chemical analysis, until it was shown that the liability of the presence of pathological micro-organisms was in direct ratio to the chemical impurity of the water, viz., its fitness to sustain them.

Thus, while a chemical analysis does not positively isolate a typhoid fever cause, it demonstrates very clearly the possibility of its existence in a given water. A water containing neither ammonia, free or in combination, nor chlorine can never develop a case of typhoid fever. These germs are always accompanied by organic matter, the nature of which determined by the chemist gives its origin and significence.

In the analyses my first endeavor was to discover any organic contamination which might inferentially lead to a suspicion of sewage pollution, such as free and albuminoid ammonia.

Secondly, to find water which might in itself be considered as dangerous, or as giving positive evidence of sewage contamination, such as chlorine. In Detroit river water, chlorine in any marked quantity cannot come from an innocent source, its presence therefore must be accepted as evidence of sewage. The amount of chlorine found, 2.0 parts per million, in our water can easily arise from an innocent cause, but the amount found in a sample of ice, 65 parts per million, can only be accounted for on the supposition of an admixture of animal excreta.

I have confined myself to giving the amounts of free ammonia, albuminoid ammonia, oxygen consumed and chlorine

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Detroit Chemical Society and contributed to the *Pharmaceutical Era.*

contained in the ice and water, these being the more important factors in determining the amount and quality of organic material present and at the same time, the probable sanitary conditions. The presence of free ammonia of itself means very little, being frequently absorbed from the atmosphere by the waters near large cities, but the additional presence of albuminoid ammonia invests it with a significance at once apparent.

The story of the present dangerous contamination of drinking water is told by the amount of this substance actually present. No arbitrary rule as to the precise point at which a given sample of water becomes impure as indicated by the albuminoid ammonia present, can be established, but it is generally agreed that the classification might be somewhat as follows:

Class I.—Water of great organic purity, yielding not more than 0.041 parts of albuminoid ammonia in 1,000,000.

Class II.—Water of medium purity, yielding from 0.041 to 0.082 parts of albuminoid ammonia in 1,000,000.

Class III.—Water of doubtful purity, yielding from 0.082 to 0.123 part albuminoid ammonia in 1,000,000.

Class IV.—Impure water, yeilding more than 0.123 albuminoid ammonia to 1,000,000.

Referring to the table appended, it will be seen that the maximum amount of albuminoid ammonia found by us in our water is well within the first-class, of water of "great organic purity." Our sister city, however, (Windsor), using water from the same source, approaches very nearly Class III, "water of doubtful purity." This can be accounted for from the fact that that city's intake is from a point below the Walkerville sewer. That Windsor water contains 0.07 parts of albuminoid ammonia per million is not in itself significant, but when taken in connection with the fact that the water farther up stream contains less than half this amount, it seems to point most positively to some foreign contamination before it reaches the consumers.

I give also the amount of oxygen consumed as this bears a direct relation to the amount of organic material contained in the water and is a valuable indicator, its significance being classified by Drs. Frankland and Tidy as follows:

Class I.—Of great organic purity, absorbing not more than .50 part per million.

Class II.—Of medium purity, absorbing not more than 1.5 part of oxygen per million.

Class III.—Of doubtful purity, absorbing not more than 1.5 to 2.0 part of oxygen per million.

Class IV.—Impure water, absorbing more than 2.0 parts of oxygen per million.

In this particular it will be seen that Detroit water is again superior, but it must be remembered that vegetable debris, in itself harmless, will greatly increase both the albuminoid ammonia and the oxygen consuming power of the water; so that to form an intelligent opinion of the value of a given water it is necessary to have a knowledge of the normal waters of the vicinity. But while an excess of these factors may not necessarily demonstrate the impurity of the water containing them, their absence from a water is proof of its purity.

Chemical analysis cannot discover the noxious ingredient or ingredients in water polluted by infected sewage or animal excreta, and as it cannot thus distinguish between infected and non-infected sewage, the only perfectly safe course is to avoid altogether the use, for domestic purposes, of water which has been polluted with excrementitious matters.

Again, referring to the table, it will be seen that the amount of chlorine found in Detroit water is less than that found in any other city, excepting Rochester. A small amount is always found in all natural waters, being derived from the sodium chloride (common salt) which is abundantly distributed in all rocks and soils.

Sewage, the polluting agent most to be dreaded in water, contains a large proportion of chlorine, as common salt, derived mostly from the liquid excreta of animals. The proportion of chlorine in uncontaminated waters is very constant, hence a marked excess over the normal standard, unless otherwise accounted for, suggests a direct contamination.

The analysis of Windsor water was made by Anthony McGill, B. A., of the Inland Revenue Department, Ottawa, Ont. Of the American cities, by A. R. Leeds.

So far as the analysis of the ice is concerned, it must be borne in mind that the impurities found do not indicate the average existing in the mass of water from which it was formed. Coming as it does from the surface and usually from near

ble Showing the Relative Purity of Water Supplied to Principal Cities.

n.	Philadelphia.	New York.	Brooklyn.	Jersey City.	Boston.	Washington.	Rochester.	Cincinnati.	Detroit.		Windsor.
									Maximum.	Minimum.	
....	143.0	118.0	60.0	93.0	85.0	115.0	100.0	162.0	123.0	101.0	104.
....	3.0	3.5	5.5	2.35	3.15	2.70	1.95	8.05	2.73	2.49	3.5
ow'r }	4.6	8.1	4.13	9.5	17 .7	6.00	7.9	8.6	.711	.662	15 min.,.394 4 hours,.812
....	.147	.221	.067	.344	.496	.221	.188	.196	.025	.02	.07
....	.008	.022	.006	.039	.108	.490	.093	.094	.012	.010	.02

esult of the Analysis of Six Samples of Ice Collected 1891-1892.

s per Million.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No 6,	
....	.05	.12	.16	.22	.32	.39	Nos. 5 and 6 unequivocally show sewage contamination.
ia..........................	.32	.16	.17	.29	1.07	1.42	
....	4.4	2.2	1.9	1.8	3.74	9.08	
....	4.8	5.0	4.75	4.80	15.50	62.45	

expect to find a greater
lic vegetable debris, etc.,
s of the kind can explain
t of chlorine and corres-
oid ammonia in Nos. 5
e freezing of water tends
has been found that 20
olloid and more than this
impurities of water are
elation.

y apparently unsurmount-
ccount for the greater im-
, such as its location near
e water, its liability to
ructure material washed
ere by light snow or rain
methods employed in
vesting the crop. While
rvesting of the crop last
ly saw animal excreta,
solid, dropped upon the
fort other than a shovel
nove it. Ice-men, in their
uld see to it that no rough
s made to purify it, but
emn it and all ice in its
ty. A piece of ice of this
to the hands of the chem-
evidence to condemn tons
re material. Good ice
e as our drinking water.
oncluded that it should
chlorine, and should yield
5 of albuminoid ammonia

ses I have been ably assisted by W. H. Allen, Ph. C., of the Department of Pharmacy of the Detroit College of Medicine, and others, to whom my thanks are due.

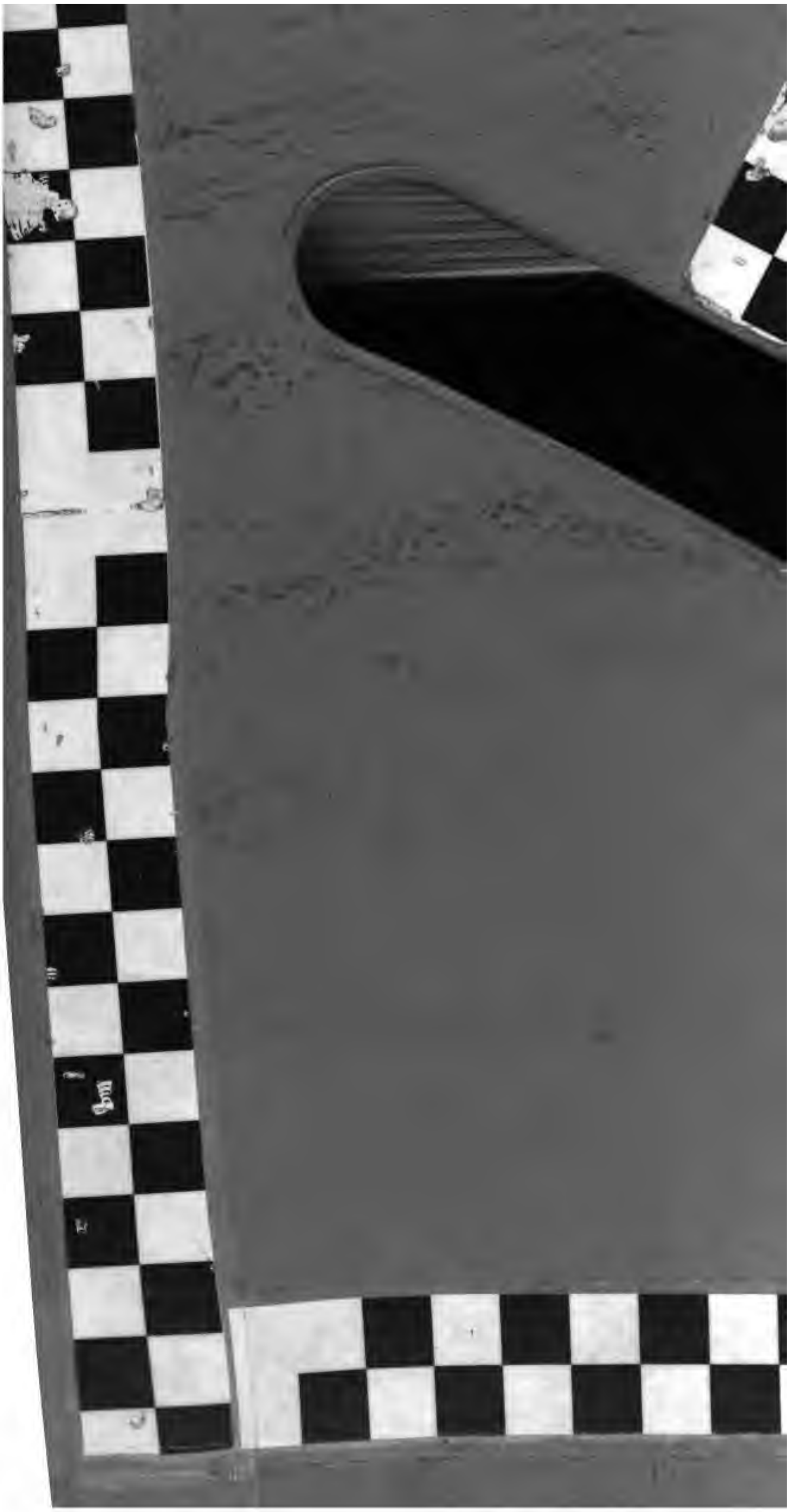
The methods followed were: For the free ammonia, Nesslers's solution to the distillate; for the albuminoid ammonia, potassium permanganate aud sodium hydrate, afterwards nesslerizing the distillate; for the quantitity of oxygen consumed in three hours, I followed Forehammer's process.

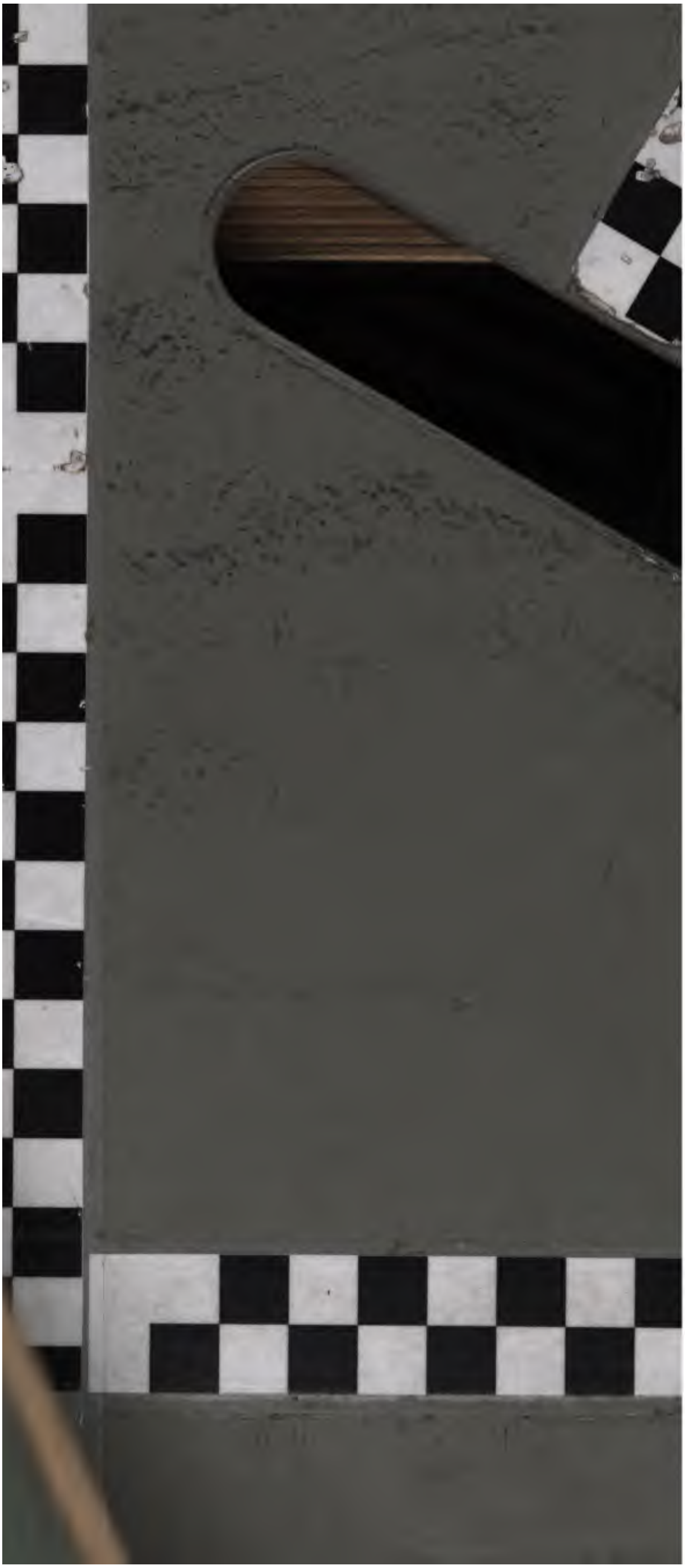
The chlorine present cannot be estimated in our waters except in concentrated solution, made by evaporating considerable quantities of the water. In some samples of the ice, however, the estimation could be readily effected without evaporation.

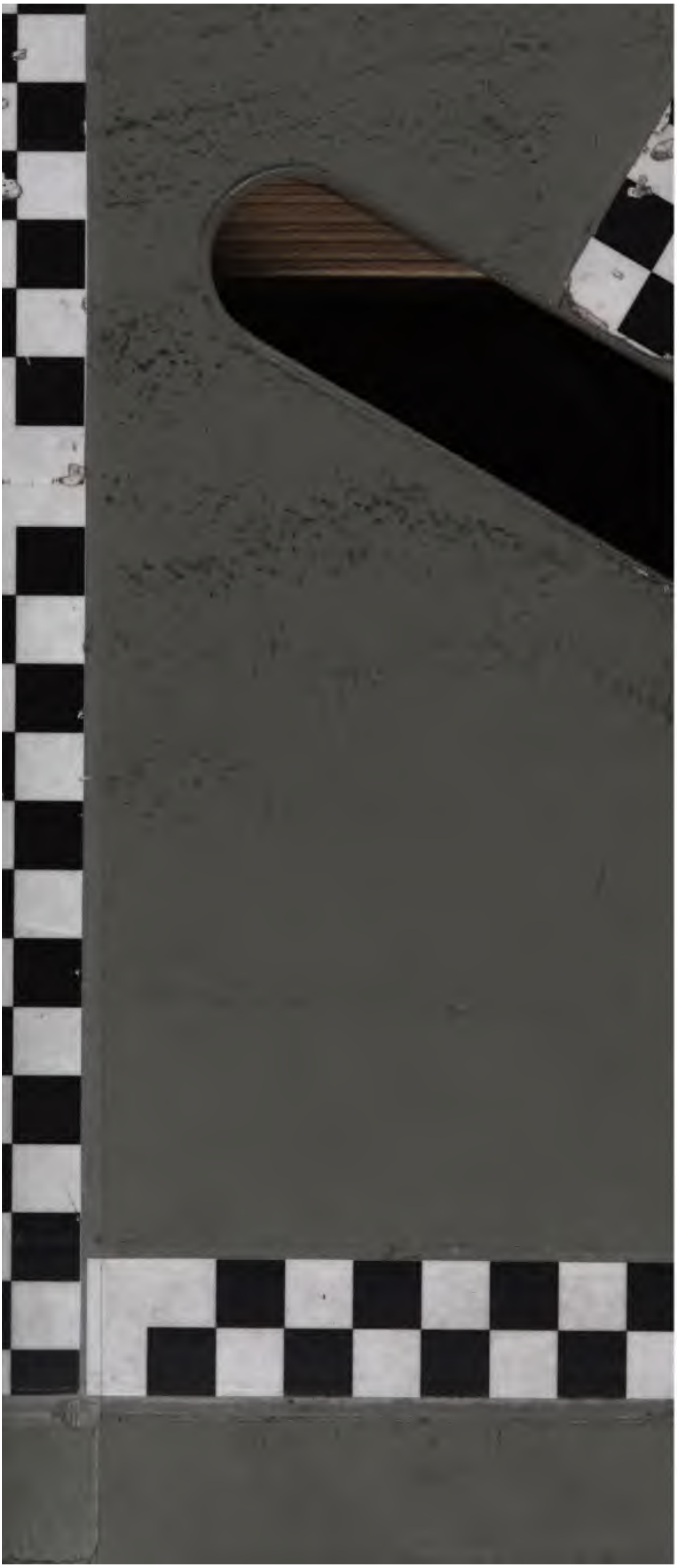
In April, 1891, I was employed by the Detroit *Evening Journal* to make a comparative analysis of Windsor and Detroit water supply. In looking up my notes I find the analysis of Windsor water to be as follows. It was very variable, depending upon the direction of the wind and the day of the week. The maximum and minimum of my analysis were as follows:

	Parts per Million.
Free ammonia—Maximum....................	.20
" " —Minimum.....................	.02
Albuminoid ammonia—Maximum............	.11
" " " —Minimum	.03
Chlorine (one analysis)......................	3.80

The result of my analyses demonstrates clearly that the water supply of our city is unexcelled for purity by that supplied to any other large city in the union.







THIRTY-NINTH

ANNUAL REPORT

OF THE

ARD OF WATER COMMISSIONERS

NEW WATER WORKS.

TO THE

OMMON COUNCIL OF THE CITY OF DETROIT,

FOR THE YEAR

1890.

Calvert Lith.Co. Detroit Mich.

THIRTY-NINTH ANNUAL REPORT

OF THE

Board of Water Commissioners

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

TOGETHER WITH THE

REPORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1890.

DETROIT:
THE DETROIT FREE PRESS PRINTING COMPANY.
1891.

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BOARD OF WATER COMMISSIONERS,

DETROIT, 1891.

MEMBERS:

JOHN PRIDGEON, 1891.	*JOSEPH L. HUDSON, 1892.
SAMUEL G. CASKEY, 1893.	AUGUST GOEBEL, 1894.

HENRY M. DUFFIELD, 1895.

* Joseph Nagel died Dec. 9, 1890, and Joseph L. Hudson appointed to fill vacancy.

COMMITTEES:

Ways and Means	Commissioners CASKEY, GOEBEL.
Extension and Construction	Commissioners HUDSON, CASKEY.
Pumping Works	Commissioners PRIDGEON, HUDSON.
Supplies	Commissioners GOEBEL, PRIDGEON.

OFFICERS:

President	HENRY M. DUFFIELD.
Vice-President	
Secretary	L. N. CASE.
Supt. of Extension and Construction	HENRY BRIDGE.
Supt. of Meters and Inspection	THOMAS R. PUTNAM.
Supt. of Grounds	E. A. SCRIBNER.
Chief Engineer	JOHN E. EDWARDS.
Assistant Engineer	URIAH GOULD.
Assessors and Collectors	HARRY S. STARKEY. MAX F. GREUNER. ALBERT W. GOODSELL. ANTHONY T. McLOGAN. FRED. H. HUTAFF. HARRY L. JAMES. AUGUST GOEBEL, Jr.
Receiving Clerk	GEORGE E. KUNZE.
Permit Clerk	THOS. P. HINCHMAN.

DETROIT WATER WORKS.

METER RATES.

First 3,000 Cubic feet, each month, each 100 gallons	⅔ of a cent.
All over, each 100 gallons	⅓ of a cent.

ASSESSMENT RATES.

From July 1st, 1886.

		PER ANNUM
For Family, household purposes		$5 00
Green Houses.—Special rates.		
Private Stables, for each horse		2 00
Livery Stables, " " "		2 00
Dray and Team Horses, each		1 00
Cows, each		1 00
Stores and Offices,	$2 00 to	20 00
Bakeries, average daily use, for each barrel of flour		3 50
Saloons, Groceries and Provision Stores, from	$3 00 to	100 00
Bar, with faucet, from	8 00 to	50 00
Fish Houses	10 00 to	100 00
Slaughter Houses.—Special rates.		
Hotels and Taverns, in addition to family rate, each room		1 00
Boarding Schools, each room		1 00
Public Schools, from	$5 00 to	50 00
Building Purposes, each 1 M brick		5
" " " 100 yards plastering		10
" " " perch stone		1½
Printing Offices. Special rates.		
Butcher Stalls, each not less than		3 00
Workshops, for 10 persons or under		3 00
" for each additional 10 persons		1 00
Estimated quantities of water each 100 gallons		2
Boarding Houses, in addition to family rate, each boarder		1 00

FIXTURES.

Bath Tubs, for families, 1st tub, $2.00; each additional		$1 00
Bath Tubs, public, each tub		5 00
Water-closets, for a family, 1st closet, $3.00; each additional, $2 00,	$3 00 to	15 00
Water-closets, for Hotels, Stores, Factories, etc., for 10 persons, $5.00; each additional person		25
Rod Water-closets, not less than		6 00
Urinals, not less than		2 00
Wash-Hand Basins, for family	$1 00 to	3 00
" " " for other purposes, each person		25
Permanent Wash Tubs		2 00
Hose	$3 00 to	30 00
Fountains	5 00 to	20 00
Street Sprinklers, each wagon		200 00

Where there is a waste of water a proper increase of rates will be made.

REPORT OF THE COMMISSIONERS.

REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

WATER COMMISSIONER'S OFFICE.

DETROIT, January 2, 1891.

To the Common Council of the City of Detroit:

The Board of Water Commissioners respectfully submits its annual report for the year ending December 31, 1890.

For the financial transactions of the Board, and the details of its Extension and Construction, and the supply of water, your attention is invited to the report of the Secretary and those of the heads of the different departments of the Works which accompany this report.

A detailed statement of the entire expenditures of the Board during the past year has already been presented to your honorable body by the Secretary of this Board.

The bonded indebtedness of the Board is $1,229,000, with an annual interest on the same of $76,610. During the past year $97,000 of bonds were presented and paid, of which amount $45,749.79 was taken from the sinking fund.

The total expenditures of the Board were $638,858.43, and the receipts were $493,846.10, an excess of the former over the latter of $145,012.33; which is accounted for by the fact that about $200,000 were spent in extraordinary construction, and $97,000 in the redemption of bonds.

A much larger sum than usual has been expended the past year in laying main and distribution pipes. Large mains varying in diameter from 16 inches to 30 inches have been laid through the central and business portions of the city. This was done upon the request and recommendation of the Board of Fire Commissioners, who, although the supply of water in this district had been ordinarily sufficient, were apprehensive that in case of a sudden great demand such as a large fire would occasion, the supply would be exhausted on account of the small size of the pipes lying in, and furnishing the water supply of this portion of the city.

They also claimed, and very reasonably, that the presence of large mains would enable them to group their engines more closely to fires than had heretofore been possible, and greatly increase thereby their execution.

The total amount of pipe laid the last season, including that of the above was $25\frac{4539}{5280}$ miles.

The last annual report stated that the necessity for a new settling basin at the pumping works had been considered and that it had been determined to proceed at once to make arrangements for its construction.

Plans and specifications were made, and an estimate of its expense, which amounted in the aggregate to $250,000.

Before, however, taking any steps for its construction, we became impressed with the idea that sufficiently good results could not be obtained for so large an expenditure. As neither the present basin nor the one contemplated, would contain a day's supply, the water therein would not remain quiescent more than 20 hours, if as long, and but little precipitation would occur. It is established by good authorities that to obtain any good results by precipitation water must remain quiet at least four days.

The analysis of the water of Detroit river by Frederick Stearns in 1879, as well as by other chemists more recently, established the fact of its more than ordinary purity, and the fact of its being equal to if not superior to that of Lake Cochituate of Boston, Mass., which is pronounced to be of "exceptional purity."

Commissioners therefore determined to abandon the idea
tructing a new basin, and to build instead a new conduit
the present basin, and leading directly to the pump
nderneath the engine house, so arranged that it could
in connection with the basin or independently. In case
mes necessary therefore to clean the basin it can be done
t interfering with the operation of the Works. Leading
he end of this new conduit at the river's bank, was
new inlet pipe extending into the river 500 ft. fur-
an either of the other two previously laid and to where
ter is palpably freer from vegetable matter and sand.

entire expense of constructing the conduit and the lay-
the inlet pipe was $43,000.

gations in the matter of the Hurlbut estate are still pend-
nd as yet the Board have not received any income from
urce, although it has already expended $5,262.30 in carry-
t the provisions of the will.

of the most important questions affecting the water sup-
the city of Detroit for the past two years has been the
pt of the Board, by the means of inspection and the in-
ction of meters, to stop the extraordinary waste that had
increasing year after year, until in 1888 the consumption
city reached the enormous amount of 200 gallons to each
itant. When it is considered that the supply in London,
at the same time was but 32 gallons *per capita*, and that
ovidence, R. I., but 40 gallons, the imperative necessity
he Board should do something remedial must be appar-
everybody.

results of the two years' operations in this regard have
more than satisfactory and confirm to the Board the wis-
f such action. The reports of the Secretary and the Su-
tendent of that department give all the details of this
the expense thereof, and many other interesting facts to
your attention is earnestly invited.

of the results of the large increase in the use of meters
fact that the Board has been enabled, through the sav-
ade by them, to reduce its meter rates from one cent for

100 gallons to one-third of a cent, a most satisfactory result to water takers generally, and especially to those who have been hitherto necessarily supplied through meters on account of the quantity of water required by them being too indefinite to estimate. These persons, and most of them large consumers, have paid one cent for each 100 gallons consumed for years, and the reduction to one-third that rate has been most acceptable to them.

Our fellow citizens should bear in mind that meters do not restrict the use of water, they only measure, and measuring the quantity of water consumed has the effect to stop the waste. They should also bear in mind, that while it is true that a vast quantity of pure water is constantly flowing by our doors, and while it may seem on that account that it should be used without any restraint, yet to provide the necessary means to carry it to the homes, to the workshops and to the factories in the city has already cost the city four and one-half millions of dollars, and it costs annually one hundred thousand dollars to operate the same.

From the experience of those cities where meters have been in use for years and where the consumption is so much less than in Detroit, it certainly seems as if a very much larger quantity of water than is necessary is still being pumped, although the consumption *per capita* has been largely reduced the past two years. No good result is accomplished by the waste of water, while the providing of engines, engine houses, coal, etc., etc., together with the expense for supply mains to furnish this quantity that is wasted, has already cost the city of Detroit a fabulous sum.

The Board cannot but feel that the interests confided to their care, as Water Commissioners, demand economy in this direction as much as in any other, and that the results already obtained sustain them most emphatically in their action in the matter.

It has been the misfortune of the Board to lose by death one of its members, who by his activity, honesty and wise economy in public affairs has won for himself a place in the confidence m of his fellow citizens. Hon. Joseph Nagel, who 9th, was appointed Water Commissioner May 1st, was elected Vice-President of the Board in May last. eeting of this Board Sept. 25th the following resoluted by your honorable body was presented :

> AS, The reservoir of the Water Works in the Seventh o longer of practical use in the water supply of the
>
> EAS, It would be a great accommodation to the people eighborhood to have streets opened through the therefore
>
> d, That the Board of Water Commissioners be and hereby requested to consider the removal of said resd report the result of their deliberations to this body.

oard was in sympathy with the preamble of this resod in pursuance to a resolution adopted Oct. 11th, a made to the city of that portion of the grounds lyof the north line of Calhoun street, and granting the to open Orleans street through the north part, reservid north part to the Board for storage purposes, for s now being used.

a portion of December, and at the making of this reBoard have been, and are experimenting with the use l gas as a fuel at the Pumping Works.

oilers are supplied with gas fixtures and four boilers s formerly for the immediate use of coal should occaire, so that should the supply of gas fail no inconveuld be felt by the citizens. Should the expense in ural gas be equal to or less than that of coal, the Board ably enter into a contract for the use of the same.

the period of experimenting the cost of gas is not to e cost of coal.

which is respectfully submitted.

HENRY M. DUFFIELD,
JOHN PRIDGEON,
SAMUEL G. CASKEY,
AUGUST GOEBEL,
Commissioners.

REPORT OF THE SECRETARY.

REPORT OF THE SECRETARY.

Plumbers' License Account:	
Paid for licenses	$510 00
Service Cocks Account:	
Stops and drilling	6,586 25
Old materials and fines	57 90
Office Account:	
Rent	1,950 00
Sale of old materials	13 40
Reservoir Account:	
Sale of lot	200 00
Sale of materials	7 00
Stop Cock Account:	
Sale of materials	53 25
Horse and Wagon Account:	
Sale of materials	15 00
Total receipts	$493,846 10

EXPENDITURES.

CONSTRUCTION.

Iron Pipe Account:		
Superintendency	$4,983 00	
Labor	84,783 29	
Pipe	137,114 96	
Specials	9,298 84	
Hauling	2,786 48	
Lumber	974 84	
Coal	203 97	
Oil	27 63	
Packing	343 77	
Office materials	23 48	
Tools and repairing of	1,504 96	
Lead	8,020 60	
Plugs	170 33	
Repaving	7,476 02	
Repairing	171 20	
Postage and street car tickets	46 00	
Freight	23 44	
Livery	82 00	
Bonus returned	17 00	
Damages	100 00	
Sewer pipe	7 14	
Tar	6 70	
		$258,165 65

REPORT

OF THE

RD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

WATER COMMISSIONER'S OFFICE.

DETROIT, January 2, 1891.

mmon Council of the City of Detroit:

3oard of Water Commissioners respectfully submits
al report for the year ending December 31, 1890.
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ention is invited to the report of the Secretary and those
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ny this report.
ailed statement of the entire expenditures of the Board
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y by the Secretary of this Board.
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nterest on the same of $76,610. During the past year
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79 was taken from the sinking fund.
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ipts were $493,846.10, an excess of the former over
er of $145,012.33; which is accounted for by the fact
out $200,000 were spent in extraordinary construction,
000 in the redemption of bonds.

REPAIRING LEAKS ACCOUNT:		
Labor	$5,396 02	
Tools and materials	155 60	
Street car tickets	231 80	
		$5,783 42
TELEPHONE:		
Rent		346 00
RESERVOIR ACCOUNT:		
Superintendent	$518 25	
Labor, repairs and materials	290 46	
Tools, etc	7 90	
Stove	8 50	
Houses for laborers	3,343 28	
		$4,168 39
OFFICE ACCOUNT:		
Secretary, assessors and clerks	$15,358 97	
Printing, advertising and subscription	1,296 96	
Watchmen and janitors	1,070 00	
Alterations and repairs	818 80	
Supplies: soap, matches, etc	96 87	
Supplies: office stationery	413 34	
Livery	66 95	
Furniture	677 44	
Safe deposit	10 00	
Insurance	231 99	
Extra services	353 80	
Floral offering	25 00	
Fuel	142 27	
Ice	44 80	
Light	140 65	
Postage and street car tickets	91 30	
Attorney	600 00	
Expert examiners	40 00	
Sprinkling	61 50	
Germicide	56 00	
		$21,596 64
SERVICE COCKS ACCOUNT:		
Clerk and labor	$5,863 19	
Tools and repairs	45 07	
Corporation stops	1,539 17	
		$7,447 43
HORSE AND WAGON ACCOUNT;		
Farrier	$186 00	
Feed	1,244 58	
Repairs	413 86	
Vehicles, harnesses and materials	936 20	
Labor	1,333 50	
		$4,114 14

REPORT

OF THE

ARD OF WATER COMMISSIONERS

OF THE

CITY OF DETROIT.

Water Commissioner's Office.

Detroit, January 2, 1891.

e Common Council of the City of Detroit:

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To the Honorable the Board of Water Commissioners of the City of Detroit:

Gentlemen—We have carefully examined the books and vouchers of the Water Works from January 1 to December 31, 1890, and find them correct.

Cash on hand in office	$3,152 52
Cash in bank	106,680 58
Total January 1, 1891	$109,833 10

Respectfully submitted,

(Signed)
DAVID R. PEIRCE,
JOHN HOSMER,
Committee.

The following table is the report of the assessment made in May and June, to commence July 1st, 1890.

The number of families assessed at that time was 41,467, an increase in one year of 2,309; and the total amount assessed, $338,586, is $2,282 less than the amount of the assessment made in 1889. This is accounted for in the last column of this statement which shows that the former assessments upon places taken off from the books at that time and upon which meters were placed amounted to $27,656; showing that the actual gain upon this assessment to have been $25,374.

WATER RATES.

ASSESSMENT FOR THE YEAR 1890–1891.

S.	FAMILIES.			Tenements Vacant.	Increase Assessed.	ASSESSMENT.		
	Assessed.	Not Assessed.	Whole Number.			1890-91.	Increase or Decrease.	$ reduced by use of meters.
....	2,835	6	2,841	29	105	$18,981	—1,901	$2,409
....	4,285	16	4,301	22	235	25,923	+ 736	852
....	7,120	22	7,142	51	340	44,904	—1,165	3,261
....	3,012	3	3,015	67	71	22,154	+ 56	1,235
....	3,373	4	3,377	49	163	22,619	+ 542	1,453
....	6,385	7	6,392	116	174	44,773	+ 598	2,688
....	2,332	.....	2,332	51	91	35,230	—3,851	5,738
....	1,991	......	1,991	69	2	40,278	—3,859	3,799
....	4,323	......	4,323	120	93	75,508	—7,710	9,537
....	2,715	......	2,715	76	109	28,206	+ 401	1,854
....	3,137	...	3,137	64	118	24,890	+1,408	632
....	5,852	.....	5,852	140	227	53,096	+1,809	2,486
....	2,821	5	2,826	29	155	19,903	+ 68	1,571
....	3,544	8	3,552	22	181	24,107	+1,070	909
....	6,365	13	6,378	51	336	44,010	+1,138	2,480
....	2,599	28	2,627	15	146	17,288	+ 763	470
h......	1,588	155	1,743	18	138	10,668	—3,580	5,154
....	1,284	410	1,694	11	317	8,357	+2,370	25
ls......	17	......	17	......	17	268	+ 268	......
......	5,488	593	6,081	44	618	36,581	— 179	5,649
.. ....	2,873	7	2,880	12	146	18,414	+1,120	512
....	1,780	6	1,786	10	166	11,521	+ 914	586
......	1,207	35	1,242	6	198	8,145	+1,097	388
k.....	74	......	74	....	11	1,634	+ 96	69
....	5,934	48	5,982	28	521	39,714	+3,227	1,555
te.....	41,467	683	42,150	550	2,309	$338,586	—2,282	27,656

The following table shows the receipts for water rates during the year, arranged by districts, and giving the amounts collected upon each annual assessment.

These receipts include the rates collected upon the assessment rolls and those received for water supplied through meters. The amount received upon the rolls was $350,599.73, and that upon meter bills $37,278, making a total of $387,877.73, an increase over that of 1889 of $19,952.46.

The reduction of meter rates during the past year from one cent per 100 gallons to one-half cent the 1st of August, and subsequently, October 1st, to one-third of a cent, reduced the income of the Board between six and seven thousand dollars less than would have been received under the old rates.

WATER RATES, 1890.

st ict.	Second District.	Third District.	Fourth District.	Fifth District.	Sixth District.	Seventh District.	Aggregate.
....	$2 25	....	....	....	....	....	$2 25
....	4 00	....	....	$3 75	....	....	7 75
....	16 00	....	....	5 00	....	....	21 00
....	....	$7 50	$12 25	....	....	....	19 75
....	2 50	3 00	20 00	....	....	....	25 50
....	23 75	....	33 25	....	....	....	57 00
....	10 00	2 50	15 75	....	$11 50	....	39 75
.5 50	25 00	108 67	51 25	37 25	57 25	....	294 92
5 03	24,259 83	44,071 97	27,661 20	24,158 82	21,497 28	21,126 62	187,160 75
.2 52	26,919 58	46,531 64	29,358 85	24,689 40	22,725 85	22,011 22	200,249 06
3 05	$51,262 91	$90,725 28	$57,152 55	$48,894 22	$44,291 88	$43,137 84	$387,877 73

BONDED INDEBTEDNESS.

The following is a statement of the present bonded debt of the Board :

AMOUNT.	ISSUED.	PAYABLE.	Rates of Interest.	Annual Interest.
$46,000 00	August 1, 1858	August 1, 1893	7%	3,220 00
50,000 00	August 1, 1859	August 1, 1893	7%	3,500 00
50,000 00	August 1, 1860	August 1, 1893	7%	3,500 00
50,000 00	Dec'r 1, 1881	Dec'r 1, 1896	4%	2,000 00
100,000 00	Sept'r 1, 1880	Sept'r 1, 1899	4%	4,000 00
100,000 00	April 1, 1881	April 1, 1899	4%	4,000 00
100,000 00	Feb'ry 1, 1870	Feb'ry 1, 1900	7%	7,000 00
50,000 00	August 1, 1872	August 1, 1902	7%	3,500 00
50,000 00	August 1, 1873	August 1, 1903	7%	3,500 00
44,000 00	Feb'ry 1, 1874	Feb'ry 1, 1904	7%	3,080 00
241,000 00	August 1, 1874	August 1, 1904	7%	16,870 00
149,000 00	June 1, 1875	June 1, 1905	7%	10,430 00
199,000 00	June 1, 1876	June 1, 1906	6%	11,940 00
$1,229,000 00				$76,540 00

NEW PUMPING WORKS.

amount expended for the new works to January 1, is as follows:

ITEMS.	EXPENDED PREVIOUSLY.	1890.	TOTAL.
....	$35,000 00	....	$35,000 00
mains..............	609,414 77	....	609,414 77
ipes................	51,356 97	$25,318 90	76,675 87
basins and canals....	129,409 12	....	129,409 12
its and conduit wells,	44,203 97	19,534 03	63,738 00
, boiler and coal es..................	159,871 90	1,102 38	160,974 28
pipe and tower......	30,420 72	....	30,420 72
wells..............	54,221 56	....	54,221 56
es	265,642 24	....	265,642 24
s....................	44,248 40	....	44,248 40
eer's house..........	7,773 14	....	7,773 14
....	3,666 25	....	3,666 25
ds..................	46,983 53	1,510 50	48,494 03
tion................	2,977 86	....	2,977 86
laneous.............	8,730 95	....	8,730 95
ggregates...........	$1,493,921 38	$47,465 81	$1,541,387 19

The following table shows the comparative condition, construction, supply and income of the Works for the years 1888, 1889 and 1890.

The daily average consumption is shown to have decreased six million in the two years, and, as by reference to the Engineer's report the increased consumption each year has usually been more than three million it follows that the actual saving the past year has been over twelve million gallons daily.

In estimating the population I have taken the number of families actually found by the Assessors and multiplied them by an average of 5.08 persons to each family, which former census returns, previous to the last one, developed as being correct, using the population reported by each census return, and the number of families found by the Assessors at the same time as a basis.

The fact that the daily *per capita* supply has been reduced in the two years from 204 gallons to 155 gallons shows a splendid result of the operations of the Board in stopping the waste. A better showing than this even would have been made, had not the construction of the new conduit at the pumping works required the throwing out of use No. 3 Engine and running No. 1 with double pumps during the months of June, July, August, September, and a part of October. The minimum capacity of this engine is much more than sufficient to supply the lower service nights and Sundays, and necessitated the partial opening of the waste gate to relieve the pressure. The daily average pumped during the seven other months was 31,612,398, or nearly two million less than that shown in the table.

	1888	1889	1890
e consumption, in gallons	39,397,716	35,274,888	33,208,067
f the city	192,729	203,992	214,122
e consumpt'n, *per capita*	204	172	155
ption for the year, gals..	14,380,166,670	12,875,334,453	12,120,914,532
through meters, in gals.	91,750,000	139,090,000	626,944,765
of total consumption, ...	.00⅔	.01	.05⅙
ervices....................	31,821	37,725	40,351
eters and indicators in the close of year	48	204	866
ibuting mains...........	343	343	362
and cisterns...........	1,913	2,237	2,410
n water rates............ n metered water	$344,315.00 9,175.00	$367,925.00 13,909.00	$387,877.73 37,278.00
revenue from metered	.02⅔	.03¾	.09¾
aintenance..............	$101,019 00	$102,587 00	$102,391 00

the objections raised to stopping the waste of water hat seemed to me more serious, and more worthy of ion than any other; and that was, that the waste aterially in cleansing the sewers and preventing, to a tent, the existence of contagious diseases. Desiring his question discussed from an authoritative standdressed a note to the *Water and Gas Review*, pub-New York, which drew out an editorial on this subject, hich I append herewith and request permission of rable body to include in my report.

WATER COMMISSIONER'S OFFICE,
DETROIT, MICH., November 23, 1890.

Editor Water and Gas Review:

SIR—I should like to see in your very interesting publication an article treating upon the question of the benefit derived —or not derived—by permitting the waste of water into sewers.

We are often met, and sometimes by educated gentlemen, with the argument that the introduction of meters and prevention of waste was operating against the health of the city; that such waste was a necessary factor in keeping the sewers clean and the city free from diphtheria and other kindred diseases. A clear, concise and logical discussion of this question would be greatly appreciated and assist us in refuting such arguments.

Yours respectfully,
L. N. CASE,
Secretary.

The editorial referred to appeared in the December issue and was as follows:

Mr. Case's letter refers to a matter which has been before the public of every municipality where meters have been introduced or efforts made to curtail the waste of water; and it is only natural that those who have a mere superficial knowledge of the subject, and who do not have the opportunity to consider it from an intelligent point of view should be misled by erroneous ideas. We believe that the question does not require much of a clear, concise and logical discussion. A simple statement of the facts as they exist, and as they have been proven to exist, is all that is necessary.

The waste, so large a factor in water consumption everywhere, running into waste pipes and sewers, has no effect whatever in removing deposits of solid matter which accumulate in them. This is proven by the fact that in many large cities where the water consumption is greatest it is necessary at frequent intervals during the year to flush the sewers for the purpose of removing the accumulation of matter which gathers there.

In the management of cities no more important matter can be contemplated than the health of the people; and questions as to the efficiency of the sewerage system properly receive a large amount of serious consideration. The liquid matter in sewers is easily disposed of, but the solid and greasy matters are desposited in the sides and bottom of the conduits, and if they were not removed they would gradually fill up the sewers

ntinuous deposit, just as river beds are filled. A con-
s or steady flow of water can have little or no effect in re-
g these matters. Heavy rain storms are the most valu-
tural agency in removing such accumulations, the influx
rge and powerful body of water flushes out and cleans
vers as no artificial agency can. Artificially, the best result
obtained by opening hydrants and permitting the flow
arge a volume of water as possible through the sewers at
times. Referring to the waste of water as tending to
the sewers, unfortunately the greatest source of waste is
l by small leakages which run continuously night and
nd the effect of such streams on the deposits in sewers is
eciable and valueless, and the quantity of water continu-
flowing which would be required to keep the sewers clear
osits would be enormous.

same rule applies to water running in a closet. This
ther great source of waste, many people imagining that
ffective in keeping the waste pipe clear. Water Works
ls have long ago designated this species of waste, along
the waste of leaky fixtures, as "driblets." A single pail
ter discharged at once into the waste pipe of a closet will
nplish more in cleaning it out all the way to its entrance
the sewer than the continuous running of that closet for
nerable days and nights, and the consequent wasting of
ands of gallons of water. This is an experiment that any
an try, and if tried, its effects will be found surprising.
force of even such a small body of water rushing in one
bulk through the confined area of a waste pipe will move
thing before it.

to the effect upon public health of the introduction of the
r system, it is only necessary to refer to the vital statistics
ose cities where the meter system has been in use for years.
death rate in Providence, Pawtucket, Worcester, Fall
r, Yonkers and every other meter city, from diphtheria and
red diseases is no greater than it is in cities where there
o meters in use, and where the water consumption is un-
ed.

continuance of the same subject I wish to add that the
age monthly rain-fall for last year was 3.07 inches, which,
in the limits of the city, amounts to a monthly average of
,436,662 gallons, or 190,000,000 gallons more than the
age quantity pumped. This difference is about the quan-
which is being pumped less than the supply of 1888.

om this we see that the rain-fall is more than six times
quantity which the Board has saved itself from pumping

by the means they have adopted for that purpose; and when we further consider that this fall of rain is confined to a few days in each month and to a few hours in each day, we find that the volume of water entering the sewers during a rain storm is at least one hundred times more than the quantity that "dribbles" in through the wastefulness of consumers, and which it is argued is necessary to cleanse the sewers, when in fact it accomplishes no good whatever.

Another argument against meters is that they discriminate against the consumer upon whom they are placed. Under our present rates this is certainly impossible, inasmuch as where the quantity of water used is estimated it is charged for at the rate of two cents per one hundred gallons, and when metered but one-third of a cent, and consequently the consumer must use more than six times the quantity the assessor thinks he uses in order to pay more than when assessed. I have also prepared the following table in this regard to show that on the contrary assessing, or estimating, discriminates against some consumers and in favor of others to a much greater degree than the meter can. As a basis for this compilation I have used their assessments before being metered and their consumption as indicated by the meter. The parties or firms considered are represented by the letters A, B, C, etc.

CONSUMERS.	MONTHLY CONSUMPTION AS PER METER.	MONTHLY ASSESSMENT.	PAID FOR 1,000 GALLONS.
A...............	583,500 gals.	$7 50	1¼ cents.
B...............	132,000 "	2 00	1½ "
C...............	3,429,803 "	36 66	1 "
D...............	531,375 "	33 33	6¼ "
E...............	185,250 "	13 67	7⅖ "
F...............	2,697,831 "	119 16	4⅖ "
G...............	472,201 "	39 66	8⅖ "
H...............	259,312 "	17 50	6¾ "
I...............	138,850 "	28 33	20 "
K...............	727,125 "	50 00	6⅞ "
L...............	2,127,050 "	53 33	2½ "
M...............	270,750 "	37 66	14 "
N...............	1,352,850 "	142 00	10½ "
O...............	462,818 "	43 00	9⅛ "

be seen by the above statement that but one of these
s paid 20 cents per 1,000 gallons, which is the rate
vhen the quantity is estimated, while one paid only
per 1,000 gallons, or one-twentieth of the amount
;he former.

PLUMBERS AND PLUMBING.

ıf the strongest desires that I have had since occupying
tion of your Secretary, has been to improve the char-
plumbing. Pursuant to that desire, I obtained from
norable body permission to establish a Board of Exam-
ıfore whom all applicants for a license should first appear
ıwer such questions pertaining to their trade as the
ard might deem advisable.

ɔril of last year the plumbers of the city assembled
r and elected three of their number, who, together with
ısioner August Goebel and Superintendent Putnam,
ed the Examining Board of last year. The plumbers
were James Lane, James Meath and Samuel Dixon,
vhom all applicants appeared who desired a license to
ıbing, and by whom they were examined.

examination developed such a lamentable ignorance of
ı ordinary knowledge of plumbing on the part of the
number of those who applied, that the Board of Exam-
ere in doubt what course to pursue. I, however, advised
ıat it would be best, inasmuch as the introduction of
innovation would meet with a great many objections
se than that which a rigorous examination would pro-
ı grant a certificate to all excepting such as were grossly
t of even the most common requirements of their
This advice was complied with, and although many
ermitted to enter this field of labor who were totally
l for it, yet a beginning has been made that will surely
n improving the character of plumbing in the city and
ecting the citizens from being victimized, as they have
r years, by men who call themselves "plumbers," and
ı are ignorant of even the meaning of the word.

rther consideration of this question the past year, and
of the fact that a large number of plumbers only

desired the privilege of the Board to do common work, I obtained your permission to issue the following circular:

WATER COMMISSIONER'S OFFICE,
DETROIT, MICH., December 10, 1890.

To the Plumbers of the City of Detroit:

Your attention is called to the fact that in April of the coming year all persons applying for a license to do plumbing will be subjected to an examination as to their ability to perform the work pertaining to their trade. This examination will be more rigid than that of last year, and a more thorough knowledge of how to perform the work of plumbing in all its branches will be required.

Inasmuch, however, as a large number of plumbers do not understand nor pretend to do sanitary plumbing, I have received permission from the Board of Water Commissioners to issue what will be known as first and second-class licenses.

A first-class license will grant permission to do all kinds of plumbing whatsoever, and a second-class license will grant permission to do the simpler or more common work of putting in service pipes and attaching to the same an ordinary hydrant in yard or faucet in kitchen.

The examination will be made in either the first or second-class, as the applicant for a license shall himself designate.

It has been found necessary the past year to require that all service pipes shall be laid at least eighteen inches away from the wall of the sewer ditch. The plumbers themselves will see the reasonableness of this requirement.

Whenever wood pipe is replaced with iron, the application for a permit must be accompanied by the signature of the party employing the plumber, signifying that it is by their wish and consent. This has been found necessary from the fact that in many cases two or more plumbers have applied for permits for the same places, causing thereby confusion and trouble to the works and the parties themselves.

You are also notified that the Board has adopted an amendment to Section 7, Chapter 3, of their Compiled Regulations, requiring all lead service pipe to be of the kind known and designated as "strong," which will take effect January 1, 1891.

It is hoped that all who desire to apply for a first-class license will take occasion in the intervening months to perfect themselves in such knowledge as is necessary to a perfect understanding of their trade.

Yours respectfully,
L. N. CASE,
Secretary.

satisfied that this plan of issuing two different kinds ses will meet the exigencies of the case, and prove tory to the plumbers themselves.

very much pleased at the manner in which my attempts ove plumbing in the city have been received by those whom they are directed, the plumbers of the City of . They have almost invariably shown the best of feel- 'ards me, and a hearty willingness to sustain me in my ɔrs.

confident that plumbers generally are as willing and ı to do their work well and honorably as any other class hanics, and just as willing to have their work scrutinized ɜmselves held to a strict compliance with any reasonable ions.

VALUATION OF THE WORKS.

uant to the plan adopted in the compilation of my last report, I have made a careful inventory of the posses- f the Board, and herewith submit the same, with their t valuations.

ıcapitulation of these values, is as follows:

uilding and lot	$51,000 00
nping works, foot of Orleans street	41,250 00
ir grounds, and improvements thereon	44,252 97
s at the new pumping works	200,000 00
gs, docks, basins, conduits, pipe, etc	731,873 28
pipe laid and in use	2,523,532 37
placed and in use	39,690 31
Total	$3,631,598 93

TOOLS AND MATERIALS ON HAND.

e building	$8,776 13
ir department	480 00
er department	4,083 62
rvoir grounds, pipe, specials, etc	41,435 94
pumping works	24,790 78
tor department	670 00
Aggregate	$3,711,835 40

INVENTORY OF THE WORKS.

OFFICE.

Office building and lot	$51,000 00	
Counter in office	600 00	
Vault	2,500 00	
Furniture in board room	583 13	
Seven tables	133 00	
Four book-cases	150 00	
Four desks	100 00	
Heating apparatus	1,400 00	
Three atlas maps	50 00	
Gas fixtures and electric light	25 00	
Two tables	15 00	
Railing	100 00	
One-half dozen chairs	10 00	
Eight stools	22 00	
Two maps	18 00	
Two clocks	20 00	
Miscellaneous properties	100 00	
One cabinet desk, upstairs	30 00	
One small desk	10 00	
One table	10 00	
One upright desk	10 00	
Two book-cases	35 00	
Three drawing tables	35 00	
One cabinet drawing table	50 00	
Drawing tools	70 00	
Maps and drawings	2,500 00	
Safe	200 00	
		$59,776 13

PUMPING WORKS.

Three lots corner of Atwater and Orleans streets		$41,250 00

REPAIR DEPARTMENT.

Tools and materials	$480 00	$480 00

METER DEPARTMENT.

Valuations of meters in use	$39,690 31	
Valuations of meters in stock	3,376 34	
Valuations of tools	171 75	
Valuations of materials	535 53	
		$43,773 93

RESERVOIR.

ing houses	$40,000 00	
	637 97	
	800 00	
ons	340 00	
	200 00	
s	300 00	
n	400 00	
	700 00	
	875 00	
		$44,252 97

INSPECTION DEPARTMENT.

	$45 00	
	500 00	
s	125 00	
		$670 00

NEW PUMPING WORKS.

	$200,000 00	
	75,000 00	
l canal	64,825 72	
ells	62,662 67	
nd coal houses	127,391 23	
tower	29,804 25	
	53,648 58	
	255,000 00	
	35,000 00	
e and barn	6,723 64	
foundation	5,316 90	
ain	175 00	
nprovements	16,325 29	
		$931, 873 28

TOOLS AND MATERIALS ON HAND.

	$1,775 47	
waste, etc.)	490 59	
s, valves, etc.)	990 85	
lead, etc.)	139 47	
	218 00	
	19,970 40	
	50 00	
	136 00	
	35 00	
s.	800 00	
ds	185 00	
		$24,790 78

IRON PIPE DEPARTMENT.

In ground:		
103 feet of 45 inch pipe	$1,699 50	
44,909 feet of 42 inch pipe	612,177 14	
695 feet of 36 inch pipe	6,234 15	
42,326 feet of 30 inch pipe	275,010 50	
55,013 feet of 24 inch pipe	273,603 33	
416 feet of 20 inch pipe	1,751 80	
87 feet of 18 inch pipe	278 40	
15,962 feet of 16 inch pipe	47,575 60	
1,973 feet of 12 inch pipe	4,439 25	
88,527 feet of 10 inch pipe	133,024 47	
156,109 feet of 8 inch pipe	170,348 10	
637,167 feet of 6 inch pipe	501,905 45	
724,036 feet of 4 inch pipe	457,323 68	
82,496 feet of 3 inch pipe	37,502 00	
2,636 feet of 2 inch pipe	659 00	
		$2,523,532 37
In Stock:		
Iron pipe	$33,268 81	
Sleeves	357 36	
Bolted sleeves	296 66	
Hub bolted sleeves	705 21	
One way branches	999 43	
Two way branches	1,138 17	
Reducers	184 36	
Bends	193 25	
Bend heads	76 58	
Curves	251 21	
Gates	1,228 00	
Caps	138 05	
Coal	26 78	
Lead	1,222 05	
Scrap iron	750 00	
Odd pieces of pipe	548 27	
Packing	51 75	
		$41,435 94
Aggregate		$3,711,835 40

ng my report I desire to express my pleasure at the harmony that has prevailed among the employees of . the past year. A desire to carry out the wishes of l as efficiently and economically as possible, prevails departments; and, from the fact that the operating of the Board are less than those of 1889, and but a re than those of 1888, it will be seen that this is a ation that is justly deserved.

ork of the Assessors and Receiving Clerk, who have e duty of collecting the revenues of the Board, your approval as much as that of the heads of depart- They strive to be courteous, though often abused; r duties, though laborious, have been performed in a , clean, and honest manner.

which is respectfully submitted.

Yours respectfully,

L. N. CASE,
Secretary.

R]

PORT OF SUPERINTENDENT OF METERS AND INSPECTION.

RT OF THE SUPERINTENDENT OF METERS AND INSPECTION.

DETROIT, January 2, 1891.

oard of Water Commissioners:

TLEMEN—In compliance with the rules of your honorable
herewith report the work done in the meter and inspec-
partments during the year 1890:

following table shows the number of meters placed
the year and the total number in service on the 31st
December, 1890:

	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
laced during the year	295	95	232	47	62	28	6	2	767
emoved for repairs, ;, not in use, etc.....	46	8	31	10	10	4	......	......	109
laced during the year service Jan. 1, 1891..	249	87	201	37	52	24	6	2	658
n service January 1, ...	49	13	80	8	25	15	8	......	198
umber of meters in Jan. 1, 1891..........	298	100	281	45	77	39	14	2	856

following tables show the kind and sizes of meters
during the year 1890, also those removed:

Placed.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
n......................	244	79	157	33	41	20	1	2	577
....	28	9	9	5	1	2	1	...	55
....	3	5	41	3	8	1	4	......	65
ngton.................	9	......	17	4	12	5	......	......	47
Rotary............. ...	9	......	4	2	......	......	......	......	15
a..................	2	2	2	......	......	......	......	......	6
....	......	......	2	......	......	......	......	......	2
placed during 1890...	295	95	232	47	62	28	6	2	767

Removed.

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson	18	5	11	5	6	......	......	......	45
Crown	13	1	1	2	1	2	......	......	20
Hersey	3	......	9	1	......	1	......	......	14
Worthington	3	2	5	......	2	......	......	......	12
Union Rotary	9	......	3	2	1	1	......	......	16
Duplex	......	......	2	......	......	......	......	......	2
Total removed during 1890	46	8	31	10	10	4	......	......	109

The following table shows the total number of meters in service and the different kinds and sizes, also indicators attached to hydraulic elevators:

KIND.	SIZES.									
	Indi-cat'rs	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson	......	228	74	147	28	36	20	1	2	536
Crown	......	45	18	52	11	12	8	4	......	150
Hersey	......	4	5	49	2	13	2	6	......	81
Worthington	......	15	1	22	4	14	8	2	......	66
Union Rotary	......	4	......	5	......	2	1	1	......	13
Niagara	......	2	2	2	......	......	......	......	......	6
Duplex	......	......	......	2	......	......	......	......	......	2
Equitable	......	......	......	1	......	......	......	......	......	1
Ball & Fitts	......	......	......	1	......	......	......	......	......	1
Indicators	10	......	......	......	......	......	......	......	......	10
Total in use Jan. 1, '91	10	298	100	281	45	77	39	14	2	866

Meters in stock January 1, 1891:

KIND.	SIZES.								
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total
Thomson	11	20	1	5	2	3	3	......	45
Crown	2	......	1	1	1	1	......	......	6
Hersey	......	......	3	1	......	......	2	......	6
Worthington	2	3	......	......	1	......	1	......	7
Union Rotary	4	......	2	2	1	1	......	......	10
Total number in stock	19	23	7	9	5	5	6	......	74

of meters in stock January 1, 1891	$3,376 34
of material in stock January 1, 1891	535 53
of tools	171 75
tal	$4,083 62
of meters in service January 1, 1890	$13,115 01
0 per cent for depreciation in value	1,311 50
esent valuation of meters in service January 1, 1890.	11,803 51
unt expended during the year for meters placed	27,886 80
tal valuation of meters in service January 1, 1891	$39,690 31

he foregoing tables you will see we have placed 658 during the year 1890, these in addition to 198 meters indicators—attached to hydraulic elevators—makes a 866 meters and indicators in service on the 1st day of y, 1891.

lacing meters we have been governed largely by the ors of the different districts, who have recommended cing of meters on premises where the uses of water were ite, also where the waste was supposed to be large.

have discovered a large number of constant flowing s that had probably been running for years without the st reason therefor, and consuming more water in one than the owner or occupant of the premises had paid for ar. Not until the first month's meter bill was presented, ere any effort made to stop the waste. The magnitude bill usually put a sudden stop to the wilful waste, a er being immediately called in and the plumbing ghly overhauled, and by doing so their bills have often educed to one-tenth of the amount of the previous month, ng that the meter is the only practical way of stopping aste.

reat many people do not seem to realize the fact that they not to use any more water than they pay for, their argu- being that there are oceans of it passing the city every nd why should'nt they let it run if they want to do so, not taking into consideration the cost of getting it to their homes or places of business.

There have been very few objections from the owners or occupants of premises where meters have been placed, and a large majority of them seem to be well pleased, and say that it is the only just way to pay for water. Those who object are usually the ones who are in the habit of letting the water run continually, and dislike being compelled to shut it off, or pay for what they use. One party said that the only objection he had to the meter was the fact that after he went home at night he worried very often, thinking he may have forgotten to shut off the water from his place of business—something he had not been in the habit of doing for years—and now if it run all night it increased his bill accordingly, otherwise he was well pleased with the meter.

We have had very little trouble with the meters in regard to their registering the quantity of water passing through them correctly. In most all cases where we have had occasion to test them we have found them absolutely correct. If in any instance there has been any defect in measurement it has invariably been in favor of the consumer. During the time the larger mains were being laid in the central part of the city, we had some trouble with sand, caused by the opening and shutting of the gates on the main pipes, which caused the sediment in the pipes to be continually on the move, and it sometimes moved in quantities large enough to stop the meters. However it has been a very simple matter to take them apart, clean, and put them in place again.

There have been several fires where we have had meters, but fortunately the meters have been saved with but trifling injury, owing largely to having them placed in the ground and properly protected. A few have had the dials broken, and in some cases it seemed to be maliciously done, but that being difficult to prove and the injury being small we have not tried to collect damages, only in one instance when maliciousness was so apparent that we required the occupant of the premises to pay for all repairs.

INSPECTION.

irst of January, 1890, there were six Inspectors who orough inspection of all water fixtures throughout They reported daily the fixtures found in each and ding examined. A copy of said report was furnished sors of the different wards who placed said fixtures essment rolls, where they were not already assessed. vere a large number of fixtures that were not on the ng to the neglect of plumbers in not reporting them y were put in. In all new buildings our inspectors areful investigation and report all fixtures so that it sible for any to escape assessment, but the trouble largely with work done on old premises and hereto- plumbers have neglected to report a large amount of k. I am pleased to say however under our present t further trouble in that respect has been overcome e holding the plumbers to a strict compliance with the verning the same. The plumbers as a class are willing rm and do so cheerfully, still it requires eternal vigi- the part of the inspectors to see that no improper done, and that all work of every description is reported plumber doing the same. With plumbers as with all ses, there are "black sheep" that need watching.

the impression with quite a number of plumbers—and wners of property for whom they work—that the Water has no right to inspect farther than the line of the lot, h point our control ends. However it requires very rious thought on their part to realize the fallacy of that Were such the case, all inspection on the part of the Board would be of little value, as the larger number of nd poor plumbing occur on the premises inside of the the lot.

of the opinion that the water Board should have control outlet as well as the inlet pipes, as the waste pipes are o arranged that only the city water flows through them, not being connected with the rainfall in any way, so that they depend altogether on the city water keeping the drains clean, and thereby causing a very large waste.

However, I suppose the drainage would more properly come under the supervision of the Sanitary department, over which we have no control.

After the examination of fixtures was completed—about the first of June—four of the inspectors were dispensed with and the two remaining inspectors took up the examination of shut-off boxes which was left unfinished the previous year. They report 544 boxes replaced or repaired and 589 premises where the owner has not complied with the notice ordering a new box—or in case the box is covered up—to have it exposed so that it will conform to the regulations governing the same.

I think another season will see the shut-off boxes in much better condition than ever before. There is great necessity of having them exposed and in good order, as the water is often required to be shut off for various reasons, such as vacancy, leak, or non-payment of rates, and if the box is not in order it necessitates a large amount of labor in doing so, often taking a man a day to do what ought to be done in a few moments. The most trouble occurs on old premises where we have no record of the location of the stop cocks, the connections having been made at a time when no record was made in this office of the location of the same, as is the custom at present.

Owners often object to putting in new boxes for the reason that they claim to always pay their rates, and we have no cause to shut off the water. But it is not always for non-payment that the water is shut off. Sometimes a burst occurs and unless the water is stopped immediately great damage may be done, this happens quite often during the winter season, and for this reason alone the shut-off boxes should always be in sight and in good condition.

During the year 36,625 examinations of service pipes were made; 1,397 leaks found and 1,290 repaired; 84 premises were ordered shut off where leaks were not repaired after having been duly notified to do so. This is a great improvement over us year when they found 3,145 leaks and 394 runms, all of which goes to prove the benefit, also the f a thorough periodical inspection.

ion to the foregoing the inspectors took the pres53 fire hydrants of which a record was made in this e find the pressure considerably increased throughty which is largely due to the meter system.

pose making an examination of every water fixture y twice each year and think that two inspectors can at the same time look after the shut-off boxes and see are kept in proper condition.

the winter months when the waste is greatest the he meter department, when not otherwise engaged, ispecting also, and by this means we hope to largely e waste that is still going on.

llowing table shows the work accomplished by the s of new work.

	Calls for Non-payment.	Shut for Non-payment.	Examined New Connections.	Let on New Connections.	Notified for Building Tax	Shut for Vacancy.
ce........	429	260	503	504	56	116
enbuhler........	588	453	589	475	85	30
rt........	881	608	557	518	92	130
r........	1,275	448	503	400	96	191
on (6 mo's.)........	287	245	303	218	19	24
e........	3,460	2,014	2,455	2,115	348	491

hed to this report is a complete list of tools on hand, temized account of the material in stock on the 31st ecember, 1890.

g the year I have conferred very often with the Secreegard to matters pertaining to the Meter and Inspection

T OF SUPERINTENDENT OF GROUNDS.

OF SUPERINTENDENT OF GROUNDS.

le Board of Water Commissioners:

EN—I regret that, owing to the vexatious litigation
but will, I have no particular improvements to
e year ending December 31.

; trees have grown wonderfully the past season, as
sand cherries. Seedlings, set out in April, 1889,
to an average height of two feet, and will, I think,
bear next year.

winds destroyed four trees, which I have not re-
ie reason that when the real work of beautifying
as Mr. Hurlbut intended, is begun, it will, I think,
to transplant some trees; and we have all the
ary for that part of the grounds north of the
. I would, however, recommend planting a row
rgreen trees along the west bank of the canal; also
of the basin, far enough away so that the leaves
e blown into the basin. The expense would not
ch, especially if the trees could be transplanted
ervoir grounds.

ke very much to cultivate a few varieties of roses.
wenty-five dollars we could propagate a selection
ids. With the usual number of men employed on
not very much can be done in the way of orna-
ers. We could make a few beds that would be
he eye, but I very much dislike to begin anything
until we have the means to carry out some fixed
iamentation that will be a credit to the place,
an ornamental iron fence, about 30 inches high,
rson avenue front; also 18-inch sewer crock laid in

the ditch along the Jefferson avenue front, with proper catch basins, the ditch filled in, finishing the top with a good layer of gravel. We are also in need of gravel for the roadways, and pebbles for the canal banks, for the cost of which I have already submitted estimates. I hope that your honorable body will agree with me on the necessity of having the above mentioned improvements begun as soon as the season will permit.

Inasmuch as the new inlet will do away with the necessity for another settling basin, I have in mind a plan for reclaiming the marsh, by dredging out an artificial lake, which, with the connection with the river, might be made deep enough and of sufficient size to allow excursion boats to land passengers right in the park.

I have nothing further to report except expenses for labor, tools, repairs, etc., which, together with the inventory, will accompany this report.

Respectfully submitted,

E. A. SCRIBNER,
Superintendent of Grounds.

OF THE CHIEF ENGINEER AT THE PUMPING WORKS.

T OF THE CHIEF ENGINEER A
PUMPING WORKS.

DETROIT, January 1, 1891.

of Water Commissioners:

EN—I have the honor to submit the Engineer's re-
year 1890:

wing table shows the number of gallons of water
d cost of fuel for the years named:

	Gallons of water pumped.	* Cost of fuel consumed.	Average daily delivered.
....	235,840,271	....	646,411
....	303,531,743	$ 2,129 37	931,594
....	376,265,126	2,271 34	1,030,866
....	542,807,364	3,325 81	1,487,143
....	692,124,305	4,017 44	1,896,231
....	697,190,523	3,993 20	1,909,837
....	718,091,207	3,655 20	1,967,373
.. ....	782,112,587	3,194 15	2,142,774
....	870,036,451	4,196 21	2,383,580
....	895,129,423	4,414 07	2,452,409
....	994,945,329	3,150 95	2,725,878
....	1,035,798,043	4,670 86	2,837,803
....	1,018,390,256	7,647 62	2,839,078
....	1,049,514 887	7,372 89	2,875,383
....	1,196,317,922	9,349 16	3,277,583
... ...	1,425,535,230	10,121 82	3,905,576
....	1,666,545,125	11,379 23	4,507,248
...	1,946,810,325	11,247 92	4,511,809
....	1,866,060,068	12,713 78	5,112,493
....	2,300,150,605	14,681 05	6,301,782
...	2,782,292,578	17,736 86	7,601,892
....	3,198,393,948	20,233 30	8,762,723
....	3,289,872,635	20,431 71	9,013,350
....	4,207,454,260	21,393 98	11,527,272
....	4,065,134,470	19,832 89	11,107,499
....	4,213,239,790	17,433 72	11,543,123
....	4,345,743,330	10,943 82	11,906,146
....	5,129,599,110	11,219 51	14,053,696
....	5,552,965,310	12,276 60	15,172,036
....	6,543,127,968	16,556 63	17,926,377
....	6,284,000,742	13,156 16	17,261,440
....	7,379,327,188	16,495 99	20,217,334
....	8,510,614,140	19,877 07	23,253,044
....	9,970,829,580	21,341 48	27,317,341
....	10,576,571,254	20,387 24	28,976,907
....	13,168,859,808	35,882 83	36,079,166
....	14,380,166,670	39,568 66	39,397,716
....	12,875,334,453	34,413 31	35,274,888
....	12,120,944,532	31,852 40	33,208,067

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RT OF THE CHIEF ENGINEER AT THE PUMPING WORKS.

DETROIT, January 1, 1891.

rd of Water Commissioners:

EMEN—I have the honor to submit the Engineer's re-
he year 1890:

llowing table shows the number of gallons of water
ind cost of fuel for the years named:

R.	Gallons of water pumped.	* Cost of fuel consumed.	Average daily delivered.
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....	4,207,454,260	21 393 98	11 527,272
....	4,065,134,470	19,832 89	11,107,499
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....	10.576,571,254	20,387 24	28,976,907
....	13,168,859,808	35,882 83	36,079,166
....	14,380,166,670	39,568 66	39,397,716
....	12,875,334,453	34,413 31	35,274,888
....	12,120,944,532	31,852 40	33,208,067

					ing.							coal.
	H.	M.										
January	288		151,649	772,968,200	$2 54	354,343	$758 29	5,932,697 cubic feet of gas used in December, equal to 624,494 lbs. of coal, included in the December run.		$760 83	72,599,343	770
February	456		241,368	434,462,400	3 67	510,067	1,091 54			1,095 21	80,272,995	851
March	744		396,890	714,402,000	7 38	833,436	1,783 55			1,790 93	80,782,055	857
April	720		366,612	659,901,600	4 20	791,972	1,694 82			1,699 02	78,526,067	833
May	384		196,170	358,106,000	2 55	410,710	878 91			881 46	81,024,111	859
June	456		261,432	470,577,600	3 44	535,718	1,146 43			1,149 87	82,780,575	878
July												
August												
September												
October	408		201,546	362,782,800	3 17	467,908	945 17			948 34	72,421,962	775
November	720		348,452	627,213,600	6 07	831,910	1,680 45			1,686 52	70,424,406	753
December	744		373,203	671,765,400		904,221	1,826 52			1,826 52		
Total	4,920		2,537,332	4,567,179,600	$33 02	5,640,285	$11,805 68			$11,838 70		
Aggregate	17,373	20	8,884,529	12,120,944,582	$89 00	15,233,740	$31,763 40			$31,852 40		

Fuel consumed	$31,768 40
Salaries, engineers, firemen	17,685 99
Boiler cleaners	800 00
Repairs and material	1,776 87
Light	58 40
Electric light plant	1,404 47
Lubricators	438 76
Supplies, cotton waste, rags, polish, etc.	396 97
Tools	108 09
Freight and express	23 13
Street car tickets	4 20
Postage	1 00
Ice	27 71
	$54,483 49

Cost per million gallons, $4 49.
Number one and two engines were run part of the year with only one pump attached.

As will be seen by the tables the amount of water pumped is 754,389,921 gallons less than the amount pumped in 1889.

Considering the fact that 2,626 new connections have been made the past year, it appears plain that the adoption of the meter system has to a large extent stopped the enormous waste of water which for years it seemed impossible to do. I am glad to notice that the head of water has been satisfactory during the past year, especially since the large pipes have been laid in the centre of the city.

The only expensive repairs to engines the past year was a new cross-head for No. three engine. A small flaw was discovered in the old cross-head, and the cross-head was immediately taken out, and when subjected to heat showed very bad forging. When the new cross-head was ordered we sent an expert to Cleveland to see the forging done. Since the new cross-head has been adjusted the engine has run almost continually and very smoothly.

The three engines are in good order and are doing very fair duty. Number one engine with one pump attached, and either of the other engines running full capacity, give us about the right power to supply the demand.

On Dec. 8 we began to test the duty of natural gas for fuel as compared with anthracite coal, taking the average duty of coal for six years as a basis, and we find 9½ cubic feet of gas equal to one pound of anthracite coal. We like the gas on account of cleanliness and convenience.

I am glad to report that the men in every branch of our work have been faithful and given close attention to their various duties.

The Thomson-Houston electric light plant started January 2, 1890, at a cost of $1,404.47, has been in use ever since, and is giving good satisfaction. Much better light than gas, which cost us about $200.00 per year. I am pleased to state that the cost for lights is very little, as our electric light engine exhausts into the receiver and the steam is utilized in the low pressure cylinder of our pumping engine. We find by using a greater number of lamps at lower candle power that we lengthen the lamps so as to make quite a saving in their cost. 16-candle power lamps and 8 of the 32-candle power. purchased during the year various attachments for amounting to $76.08, most of which is on hand. Ex- oil was $28.50 and for repairs $5.45. We have burnt candle power lamps. Most of the lamps now in use ed about 4,000 hours.

suggest that when the work of rebuilding the dock ing the basin is begun, that the trestle over which nsferred from vessels to coal houses be examined, as consider it safe and am of the opinion that it can not gain without some repairs, as some of the timbers are h decayed.

the galvanized iron gutters have been put inside of cast iron on the engine house, I have not noticed any ugh the walls. The gutters on the coal sheds are also ry, and the buildings are all in very good condition.

which is respectfully submitted.

JOHN E. EDWARDS,
Engineer.

PORT OF THE SUPERINTENDENT OF EXTENSION AND CONSTRUCTION.

T OF THE SUPERINTENDENT OF EXTENSION AND CONSTRUCTION.

DETROIT, January 2, 1891.

rd of Water Commissioners:

EMEN—In accordance with the regulations of your
e body, I have the honor to present my annual report
o the general condition and progress of the work in
rtment.

; the past year extensive additions have been made
rge mains in the more central business portions of our
re being a pressing need in this locality for a more
apply of water for fire and manufacturing purposes,
ally for fire. So many changes have been made in
fine residence property assuming the appearance of
le business blocks, and the replacing of small business
ith the extremely high ones, that since the Gray &
the Fire Commissioners have had cause to be anxious
fficient supply of water in case of a large conflagra-
have petitioned your honorable body to come to their
, in recognition of this fact, your honorable body
d me to look into the matter and present some plan
ld best meet this need. Several plans being presented,
chosen requiring the laying of 5¾ miles of pipe, of
ging from 16 to 36 inches in diameter, which was
ast season in the following streets and avenues, the
ply being from the lower 42-inch main in Congress
om which a 36-inch main is laid in St. Aubin avenue
plain street, running west to Randolph street, thence
point in Bates street, south to Congress street, and
ss street running west to Sixth street. From this

continuous line of 30-inch main, five new lines of 24-inch mains were laid, north and south as follows: In Hastings street from Champlain street to Jefferson avenue; in Woodward avenue from Jefferson avenue to Cadillac square; in Cass street from Jefferson avenue to Fort; in Third street from Larned to Fort streets; also in Sixth street from Congress to Abbott streets. Four of these lines were connected with two lines of our old 24-inch mains, at the following points: Champlain and Orleans streets, Hastings and Congress streets, Woodward avenue and Cadillac square, and at Sixth and Abbott streets.

In addition to the above, and connecting thereto, five lines of 16-inch pipe have been laid, as follows: In Jefferson avenue from Hastings to Second streets; in Larned street from Hastings to Third streets; in Fort street from Woodward avenue to Seventh street; and in Woodward avenue from Jefferson avenue to Atwater street; also a short line in Sixth street, from Congress to River streets.

All of the above-mentioned lines are now in use, with the exception of a section of the 30-inch and 36-inch mains between Orleans street and St. Aubin avenue; the cause of this was the lateness of the season before receiving the 36-inch gate, which we require to make our final connection to the lower 42-inch main. This, however, will receive our earliest attention the coming season.

Not one of the streets or avenues through which the new lines have been laid, but some one of the distribution pipes have been connected therewith, the pressure having been greatly improved, relieving the overdrawn pipe in this locality.

The pipe and special castings were furnished by the Detroit Pipe & Foundry Co.

PIPEAGE.

iount of distribution pipe and mains laid and relaid e past season, and iron and wood pipe discontinued, ws: Total iron pipe laid and relaid, $25\frac{4530}{5280}$ miles, 2,717 feet was relaid, and 2,198 feet laid for private l pipe discontinued, $4\frac{4830}{5280}$ miles, and iron pipe, $1\frac{3907}{5280}$ king the net increase of the pipeage $18\frac{1439}{5280}$ miles. unt added to the measured lines of iron and wood nected with the works, will make the total length miles, of which $351\frac{1826}{5280}$ miles are iron and $10\frac{2309}{5280}$ od pipe, which in detail is as follows:

e,	Measured length in feet for 1889.	Added length in feet, 1890.	Discontin'd length in ft., 1890.	Total length in feet for 1890.
....	103			103
....	44,909			44,909
....		695		695
....	32,400	9,926		42,326
....	49,693	5,320		55,013
....	461			461
....	87			87
....	1,552	14,410		15,962
....	1,973			1,973
....	86,022	2,505		88,527
....	142,391	13,718		156,109
....	603,255	34,010	98	637,167
....	661,236	48,925	5,625	724,036
....	85,980	2,106	3,484	84,602
....	2,636			2,636
	1,132,698	131,615	9,187	1,855,106

REPAIR DEPARTMENT.

partment of the work has received prompt attention
ny items coming under its care. Three thousand
dred and seventy-nine taps were made with the dis-
pipes of sizes from ⅝ to 1 inch, and thirty-four from
hes.

ak in the Buchanan street 30-inch main west of Twen-
street, which occurred early Sunday morning, Oct. 19,
split its entire length, and on the under side, being
lar to the one which occurred about a year ago in the
inch main, east of Vandyke avenue, at a point about
from the works; this one, in the 30-inch, being in
extreme westerly main, eight miles from said works.
id not find, after careful examination, any good rea-
tribute the break to the material the pipe was made
e of the opinion that it was caused by water hammer,
from a sudden closing of some one of the large con-
in this district, or it may have been an undue accuma-
air in the pipe. We are preparing to attach a system
atic relief valves at such points as we may see the
ains may require them, the placing of which I think
iate the difficulty.

PUMPING WORKS.

mpliance with the request of your honorable body,
d specifications, with estimate of cost, for the building
r settling drain, were presented early the past season
r consideration. As a result of the same, the question
en as to the actual need of an additional settling basin,
serious doubts as to whether any adequate benefits
be realized from its use in addition to the old one,
being about the same, and whether it would warrant
enditure of over a quarter million of dollars; for it
e considered that its greatest capacity, from our pres-
of pumping, would not allow but 10 to 12 hours'

time for the subsidence of any floating matter that may be in the water, before passing to the pump, which is less than one-fourth of the time usually estimated for that purpose. So in view of this fact, and also, that from year to year increasing demands for more water will be needed for our city, the settling basin system becomes less useful unless we have sufficient area to build on a much larger scale. I think the question now is whether we really require one at all, and if the condition of the water is at all improved by passing over the accumulated sediment subsided therefrom before passing to the pumps. The chief advantage of this settling basin now seems to be in its storage capacity. Though less than three-fourths of a day's supply, it has at times saved our city from being entirely out of water when the intake strainer boxes have been clogged with anchor ice, which is no small matter. I see, however, in Mr. Edwards' report of 1888, a statement which he makes, that lessens our anxiety with regard to anchor ice. He says, that since the building of Belle-Isle bridge, the piers supporting the bridge act as a dam, blocking the floating ice, causing a light covering of ice to form much earlier than ever before over the strainers of the inlet pipe. So, in view of this fact with the present basin now in use, and the short space of time allowed for settling, and that a continuous running stream is more healthful than water taken from a storage reservoir, and that the Detroit river water above the city, from which point our supply is taken, rates high for purity, and that the new inlet, completed the past year, extends 500 feet beyond the old ones, the water at this point being less disturbed by high winds than nearer the shore, I am of the opinion that with the new inlet pipe and conduit, the building of an additional settling basin is unnecessary.

Now as it is necessary to make some extensive repairs upon the old basin, and to do this it will require the same to be kept empty, the question has been, how shall we supply water to the works while these much needed repairs are being made, for this basin was the only source through which the water could be obtained. The original plan proposed was to build n, and through it the supply would be had. As the f a new settling basin is abandoned, a plan was to build an independent line of conduit and inlet s plan being adopted, the same was built parallel ast line of the pumping works grounds, between the ence and the old basin. With this arrangement we un independent of this basin, which will enable us t, and when requiring to be cleaned.

w conduit and inlet pipe has an inner diameter of id a total length of 2,656 feet; three gate wells and ot branch connection are attached to this line, the nnecting with the old basin in south end, the north ecting with the old line of effluent conduits. Two e wells have an inner diameter of 12 feet, and one ie depth of each is 21 feet. Strainer plates and sluice placed in each well. The contracts for the above e awarded to the following parties:

t and wells, G. S. Langley, Detroit; iron inlet pipe, Pratt, Detroit; dredging for inlet pipes, Capt. T. ledo, O.; laying inlet pipe, Michigan Dock Builders, sluice gates, Russel Wheel and Foundry Co., Detroit.

ipe—The 5-foot pipe should be taken up and relaid id in line parallel with the grounds north and south. this pipe now lies has caused no small amount of n laying the new inlet pipe on account of its close to the east line, the pipe lying diagonally across ids being so near the trench for the new inlet that a f it slid into it causing one of the joints to come Ve find considerable of the pipe very near the surface er. When this work is being done, it would be well its length, carrying the strainers out into the river the new line. This would extend the line about the section through the river bank to be of brick, d strainer well intersecting the same. It would be ctend the No. 2 inlet pipe also, as this is all of 500 ter than the new line.

East dock—The repairs recommended to be made on this dock, as mentioned in last year's report, have not as yet been made. This delay is largely owing to the fact that this work would be better done in connection with the repairs to be made on the settling basin, the said dock being the dividing wall between the canal and basin.

In closing this report it is only courteous to say that the help in the office of my department has been very efficient and the co-operation with the other departments very harmonious.

Transmitted with this report are the locations of pipes and gates, also inventory of pipe, special castings, and tools on hand to January 1, 1891.

HENRY BRIDGE,

Superintendent of Extension and Construction.

PEAGE OF THE CITY OF DETROIT.

D BY STREETS, SHOWING THE KIND AND SIZE OF THE IRON AND WOOD PIPE NOW IN USE.

LOCATION.	DIAM. INCHES.	KIND.
n Vinewood 439 feet	4	iron.
om Cass to Tenth	24	“
lley s. of, from Cass to w. line of Lognon farm	4	“
lley s. of, crossing Sixth	6	“
lley n. of, from First to Twelfth	4	“
m 424 ft. s. of Wight to Jefferson.	4	“
from John R to Randolph	6	“
from Witherell to Hastings	4	“
alley s. of, from 240 feet e. of Clifford to Cass	4	“
alley n. of, from Woodward to 100 ft. w. of Cass	4	“
from Woodward to St. Antoine	4	“
from St. Antoine to Hastings	2¼	wood.
from Hastings to Orleans	4	iron.
e. from Orleans 36 feet	18	“
from Orleans to Gratiot	10	“
crossing Field	4	“
ave., from Woodward to Cass	6	“
“ from Cass to Third	4	“
“ w. from Fourth 150 ft	3	“
“ e. from Crawford 430 ft	4	“
“ from Sixth to Seventh	4	“
“ from Woodward to Brush farm	4	“
“ w. from Beaubien 195 ft	4	“
“ from Beaubien to St. Antoine	3	“
“ from St. Antoine to Rivard	3	wood.
“ from Rivard to 325 ft. e. of Russell	2¼	“
“ crossing St. Antoine and Hastings	4	iron.
“ crossing Rivard and Russell	4	“
“ from 260 ft. w. of Orleans to alley w. of Dubois	4	“
“ from alley w. of, to Dubois	3	“
“ crossing Dubois and Chene	4	“
“ from Dubois to Chene	3	“
“ from Chene to 63 ft. e. of	3	“
“ from 63 ft. e. of Chene to Grandy	3	“
“ crossing Grandy.	3	“
“ from alley e. of McDougall to 401 ft. e. of Moran	4	“
from Woodward to Rivard	4	“
from Rivard to Russell	2¼	wood.
from Russell to Orleans	3	iron.
from Orleans to Dubois	4	“
, w. from Junction 314 ft	4	“
st., e. from Junction 558 ft	4	“
, w. from Junction 400 ft	4	“
st., from 462 ft. w. of Russell to 22 ft. w. of McDougall	4	“

LOCATION.	DIAM. INCHES.	KIND.
Antoinette ave., crossing Second, 43 ft.	4	iron.
“ e. from Second, 165 ft.	3	“
“ w. from Twelfth, 193 ft.	4	“
Arndt st., from Gratiot to Jos. Campau	2¼	wood.
“ crossing Jos. Campau	4	iron.
“ e. from Jos. Campau 275 ft.	2¼	wood.
“ from 275 ft. e. of Jos. Campau to alley w. of McDougall	3	iron.
“ from alley east of McDougall to Elmwood	3	“
“ from Elmwood to Mt. Elliott	4	“
Artillery ave., crossing River	6	“
Ash st., from Grand River to alley e. of Trumbull	4	“
“ from alley w. of Trumbull to National	3	wood.
“ from Harrison to Twelfth	4	iron.
“ from Twelfth st. to alley e. of Wabash	2¼	wood.
“ w. from Wabash 148 ft.	4	iron.
“ crossing Fifteenth and Sixteenth	4	“
“ from Seventeenth to Eighteenth	3	“
“ crossing Eighteenth to alley w. of	4	“
“ e. from Humboldt, 166 ft.	3	“
“ from Humboldt to Sullivan	4	“
“ w. from Sullivan 214 ft	3	“
“ e. from Maybury 250 ft	4	“
“ crossing Tillman and Twenty-fourth	4	“
“ from Tillman to Twenty-third	4	“
“ from Twenty-third to Twenty-fourth	2¼	wood.
“ from Twenty-seventh to Vinewood	4	iron.
Atwater st., from Griswold to Shelby	3	“
“ from Griswold to Bates	6	“
“ from Randolph to 215 ft. e. of St. Aubin	4	“
“ from 215 ft. e. of St. Aubin to McDougall	6	“
“ alley s. of, from alley w. of Bates to Randolph	4	“
Aurelia st., from Twelfth w. 180 ft	4	“
B st., w. from Vinewood 313 ft	4	“
Bagg st., from Woodward to Fifteenth	24	“
“ from Fifth to Crawford	3	“
“ crossing Crawford	4	“
Bagley ave., from Park to Clifford	4	“
“ alley e, of, from alley n. of Park to Cass	4	“
“ alley w. of, from 230 ft. n of Clifford to Grand River	4	“
Baker st., from Seventh to Twenty-fourth	8	“
“ from Twenty-fourth to Vinewood	4	“
“ crossing Vinewood 29 ft	6	“
“ from Hubbard to Scotten	4	“
“ from Seventh to Eighth	4	“
Baldwin ave., from Jefferson to Kercheval	6	“
“ crossing Mack	10	“
Baltimore ave., from Woodward to Crawford	4	“
“ from Woodward to Brush	3	“
Bates st., from Atwater to Farmer	6	“
Beech st., from First to Seventh	4	“
Beacon st., from Brush to 211 ft. e. of St. Antoine	4	iron.
Beaubien st., from Atwater to Clinton	6	“
“ crossing Champlain	8	“
“ from Clinton to Watson,	4	“
“ from Watson to Harper	10	“
“ from Harper to N. Boulevard	6	“

LOCATION.	DIAM. INCHES.	KIND.
Jefferson 585 ft	6	iron.
ft. n. of Jefferson to 282 ft. n. of St. Paul	4	"
ft. n. of St. Paul to Kercheval	6	"
ck to 777 ft. n. of Sylvester	6	"
atiot to 190 ft. n. of Forest	6	"
rood to 28 ft. w. of Twenty-seventh	4	"
fferson to 1,193 ft. n. of Waterloo	6	"
Mack to 113 ft. n. of Pulford	6	"
lvester to Superior	6	"
Gratiot	6	"
Gratiot 2,162 ft	4	"
lle to St. Aubin	2¼	wood.
ubin 300 ft	4	iron.
ois 100 ft	3	"
bois and Chene	4	"
to Chene	3	"
to Grandy	3	"
y to Jos. Campau	2¼	wood.
ougall 402 ft	4	iron.
to Russell	4	"
t to Jos. Campau	3	"
. Campau and Elmwood	4	"
mpau to alley w. of McDougall	2¼	wood.
. of McDougall to Elmwood	3	iron.
to Mt. Elliott	4	"
y-seventh to 190 ft. e. of Vinewood	4	"
e, from 6-inch main to n. line of Jefferson	6	"
, from Jefferson to Congress	6	"
ides, crossing Mack	4	"
ng Gratiot	4	"
Twelfth w. south side, 861 ft	4	"
le, from w. line of Grand River to 600 ft. e. of e. ne	4	"
le, from e. line of Grand River to e. side of W. oulevard	4	"
le, Woodward to Russell	4	"
e, from N. Boulevard s. 161 ft	4	"
Baker to Shady Lane	3	"
de, from Shady Lane to 120 ft. n. of Porter	4	"
de, n. from Fort st. main 40 ft	4	"
le, from Shady Lane to 560 ft. s. of Porter	4	"
le, n. from Fort st. main 44 ft	4	"
s 356 ft	4	"
ird to Fourth	2¼	wood.
ward to Beaubien	6	iron.
ien to Russell	4	"
s to Third	4	"
rd to alley w. of	2¼	wood.
y west of Fourth to Crawford	4	iron.
rth to alley w. of	4	"
th to Seventh	4	"
ubbard to Junction	4	"
143 ft. e. of Seventeenth to Eighteenth	4	"
ash to Russell	4	"
pelle to Gratiot	4	"
ineteenth 284 ft	4	"

LOCATION.	DIAM. INCHES.	KIND.
Brevoort pl., crossing Twenty-second	4	iron.
" e. from Twenty-second 240 ft	~~2¼~~	~~wood~~
Brigham st., from Third to Grand River	30	iron.
" from Fourth to Eighth	4	"
" crossing Lincoln	4	"
" crossing Twelfth to 196 ft. e	4	"
Bristol pl., from Twenty-first to Twenty-second	4	"
Brush st., from Atwater to Jefferson	6	"
" from Jefferson to Congress	4	"
" from Congress to Gratiot	8	"
" from Gratiot to Wilkins	4	"
" from Edmund pl. to Watson	24	"
" from Watson to Benton	6	"
" crossing Eliot and Rowena	4	"
" n. from Baltimore 280 ft.	3	"
" from 280 ft. n. of Baltimore to 251 ft. n. of Milwaukee.	4	"
" from Horton to Hamlin	4	"
Bryant st., w. from Twelfth 132 ft	2¼	wood.
Buchanan st., from Grand River to Vinewood	30	iron.
" w. from Wabash 172 ft	4	"
" from Fourteenth to Fifteenth	4	"
" w. from Seventeenth 169 ft	4	"
" from Eighteenth to 387 ft. w. of Humboldt	4	"
" from 75 ft. e. of Sullivan to w. line of Maybury	4	"
" Twenty-third to Twenty-fourth, w. line	4	"
" from Scotten to Twenty-ninth	4	"
" from Twenty-eighth s. to Twenty-eighth n. 70 ft	6	"
" from Campbell to Wesson	4	"
Bushey st., from Michigan to Julia	6	"
Butternut st., from Seventh to alley e. of Trumbull	4	"
" from alley w. of Trumbull to National	4	"
" e. from Wabash 263 ft	4	"
" e. from Maybury 227 ft	4	"
" from Fifteenth to Twenty-fourth	24	"
C. st., w. from Vinewood 432 ft	4	"
Cadillac ave., from Pumping Works to Mack	42	"
" from 1,000 ft. n. of Jefferson to 2,050 ft. n. of	6	"
Cadillac Square, s. side, from Woodward to Randolph	24	"
" n. side, from Monroe to Bates	6	"
" alley s. of, from Bates to alley w	4	"
" alley n. of, from alley w. of Bates to Randolph	4	"
Calhoun st., from Brush to Russell	4	"
" w. from Riopelle 159 ft	4	"
" from Dequindre to St. Aubin	2¼	wood.
" crossing St. Aubin	4	iron.
" from St. Aubin to Dubois	2¼	wood.
" from w. line of Dubois to e. line of Chene	4	iron.
" from e. line of Chene to 306 ft, e	2¼	wood.
" from 306 ft. e. of Chene to Grandy	8	iron.
Campau st., from River to Fort	6	"
" n. from Dix 448 ft	4	"
Campbell ave., from River to Driggs	6	"
" from 324 ft. s. of Fort to Celeron	6	"
" from Romeyn to n. line of Dix	6	"
" from 270 ft. s. of Toledo ave. to s. line M. C. R. R	6	
" from Buchanan s. 447 ft	6	

LOCATION.	DIAM. INCHES.	KIND.
om Woodward to Third	30	iron.
om Woodward to Third	4	"
lley n. of, e. from Second 150 ft	3	"
rom Fourth to Crawford.	4	"
rom Sixth to Seventh	3	"
rom Twelfth to 48 ft. e. of Thirteenth	3	"
from Thirteenth 48 ft	4	"
rom Woodward to Collins	42	"
rom Woodward to Collins	6	"
alley n. of, e. from Hastings 350 ft	3	"
w. from Mt. Elliott 767 ft	4	"
rom Jefferson to 210 ft. n. of Kercheval	6	"
rossing Mack.	6	"
from Twelfth 192 ft	3 & 4	"
Woodbridge to Jefferson	8	"
Jefferson to Congress	24	"
Fort to alley s. of	24	"
Jefferson to Joy	10	"
m Joy to Alexandrine	8	"
n Alexandrine to 118 ft. s. of M. C. R. R	6	"
ssing Putnam, w. side	4	"
m alley n. of Michigan to Spencer	4	"
ssing Canfield	8	"
y w. of, from alley n. of Adams to 119 ft. s. of Gilman	4	"
y w. of, s. from Gilman 119 ft	3	"
y w. of, from Ledyard to Bagg	2¼	wood.
, from Gratiot to Rivard	4	iron.
from Rivard to Dequindre	4	"
crossing Rivard	6	"
from Dequindre to St. Aubin	3	"
from St. Aubin to Elmwood	4	"
., from 188 ft. s. of Cadet to n. line of Dix	6	"
from Dix to Toledo	4	"
from Junction to 274 ft. w. of Campbell	4	"
m Twelfth to Thirteenth	4	"
m Thirteenth to Wabash	3	"
st., from Randolph to St. Aubin	30	"
from Randolph to alley e. of	4	"
from St. Antoine to Orleans	4	"
from Orleans to Elmwood	6	"
from Elmwood to 250 ft. w. of Leib	4	"
w. from Leib 250 ft	3	"
from Leib to Helen	4	"
from East Boulevard to Field	4	"
alley n. of, from Brush to St. Antoine	4	"
from Sixth to Seventh	4	"
st., from Chene to e. line Jos. Campau	4	"
from Jos. Campau to alley w. of McDougall	3	"
from alley e. of McDougall to Elmwood	4	"
re., from Woodward to alley e. of Third	4	"
w. from Fourth 131 ft	3	"
e. from Fifth 180 ft	4	"
ossing Riopelle	4	"
om alley e. of Russell to Riopelle	3	"
om Atwater to 131 ft. s. of Hendrie	6	"
om 136 ft. s. of Medbury to Harper	6	"

LOCATION.	DIAM. INCHES.	KIND.
Chene st., from Congress to Canfield	30	iron.
“ Second alley e. of, n. from Forest “main,” 36 ft	4	“
“ Second alley e. of, n. from Forest 260 ft	3	“
Cherry st., from Grand River to alley w. of Trumbull	4	“
“ from alley w. of Trumbull to National	3	“
“ from Harrison to Twelfth	2¼	wood.
“ e. from Twelfth st. “main,” 36 ft	4	iron.
Chestnut st., from Russell to Elmwood	4	“
Chipman st., e. from Nineteenth 246 ft	4	“
Chope pl., from Grand River s. 167 ft	4	“
Church st., from e. side Tenth, w. 170 ft	4	“
“ alley s. of from Eighth to Tenth	4	“
Clark ave., from River to Fort	8	“
“ from 1,000 ft. n. of Fort to s. line of M. C. R. R	8	“
“ from s. line of M. C. R. R. to Michigan	6	“
“ in Car Works grounds	6	“
“ from Michigan Car Works to Michigan	4	“
Cleveland pl., crossing Crawford	4	“
“ from Crawford to alley w. of Fourth	3	“
Cleveland st., e. from St. Aubin 176 ft	4	“
“ from 278 ft. w. of Dubois to Chene	2¼	wood.
“ e. from Chene 377 ft	3	wood.
“ from 377 ft. e. of, to 582 ft. e. of Chene	2¼	wood.
“ w. from Jos. Campau 314 ft	4	iron.
“ crossing Jos. Campau	4	“
“ e. from Jos. Campau 400 ft	3	“
“ from alley e. of McDougall to Elmwood	4	“
“ e. from Elmwood 650 ft	3	“
“ from 650 ft. to 762 ft. e. of Elmwood	4	“
Clifford st., from alley w. of Griswold to Washington, e. line	4	“
“ from Park pl. to Sproat	4	“
Clinton ave., from Gratiot to Rivard	10	“
“ from Rivard to Orleans	16	“
“ from Orleans to Elmwood	8	“
Collins st., from Gratiot to Canfield	42	“
“ from Leland to Canfield	4	“
“ n. from Canfield 563 ft	3	“
“ from 563 ft. n. of Canfield to 26 ft. n. of Hancock	4	“
Columbia st., from Woodward to Cass	4	“
“ from Woodward to John R	6	“
“ from John R to Beaubien	4	“
“ from Beaubien to Rivard	6	“
“ alley s. of, from Woodward to Cass	6	“
Columbus ave., s. from Fort 570 ft	3	“
“ crossing Fort	4	“
Commonwealth ave., crossing Putnam	6	“
“ from Kirby to 7 ft. n. of Stanley	6	“
“ s. from Holden 214 ft	6	“
Concord ave., from Jefferson to 20 ft. n. of Waterloo	6	“
“ from 211 ft. s. of Berlin to Mack	6	“
“ from 444 ft. s. to 768 n. of Gratiot	6	“
Congress st., from Bates to Sixth	30	“
“ alley s. of, from Griswold to Third	4	“
“ alley s. of, from Fourth e. 250 ft	4	“
“ alley s. of, from Sixth to Seventh	4	“
“ alley s. of, from 80 ft. e. of Brush to St. Antoine	4	“

LOCATION.	DIAM. INCHES.	KIND.
f, from alley w. of Woodward to Shelby	4	iron.
f, from Shelby to Cass	6	"
f, from Cass to Fourth	4	"
f, from Fourth to Seventh	8	"
f, from Seventh to Eighth	4	"
f, from alley e. of Woodward, 94 ft. e., in Russell e	3	"
f, from alley west of Brush to St. Antoine	4	"
dolph to St. Aubin	24	"
Aubin to Meldrum	42	"
es to Brush	4	"
Antoine to Mt. Elliott	4	"
Helen 171 ft	4	"
ine of East Boulevard to Field	4	"
bley n. 378 ft	3	"
gg to Lothrop	6	"
Lothrop 3,984 ft	4	"
Brigham	8	"
efferson	4	"
fferson 372 ft	3	wood.
ack	6	iron.
Antoine to Elmwood	4	"
Leib 216 ft	4	"
Helen 185 ft	4	"
rom John R to Randolph	4	"
bley to Milwaukee	4	"
oodward 250 ft	4	"
rush 215 ft	4	"
land to Hastings	4	"
od 300 ft	4	"
Twelfth	4	"
lfth to Thirteenth	3	"
ndry to Twenty-second	4	"
nty-third to Twenty-fourth	4	"
. of Moran to 320 ft. e. of Collins	4	"
oodward to Cass	4	"
dore 280 ft	2¼	wood.
oodbridge to Jefferson	6	iron.
y to Waterloo	4	"
Adelaide 206 ft	4	"
lfred to Pierce	4	"
anfield to Willis	4	"
of, s. from Ferry 116 ft	2¼	wood.
sh to St. Aubin	4	iron.
-fourth to Artillery	10	"
g River	6	"
line of Fort to Army	6	"
0 ft. s. of Cadet to n. line Dix	6	"
ction to Campbell	4	"
ain to Lady's Lane	4	"
klin to Clinton	6	"
on to Hunt	8	"
to Leland	6	"
d to Canfield	3	"
eld to Farnsworth	4	"
eld to Warren	4	"

LOCATION.	DIAM. INCHES.	KIND.
Dubois st., from Farnsworth to 188 ft. n. of Frederick	4	iron.
" from Ferry to 110 ft. n. of Palmer	4	"
" from Medbury to Harper	4	"
Duffield st., from Woodward to Cass	4	"
Dunn st., e. from Wesson 160 ft	3	"
E st., w. from Vinewood 416 ft	4	"
" from Twenty-sixth to e. line of W. Boulevard	4	"
Edmund pl., from Woodward to Brush	24	"
Eighth st., from River to alley s. of Fort	4	"
" from Fort to alley n. of	2¼	wood.
" from Baker to Michigan	3	iron.
" from Michigan to Orchard	2¼	wood.
" from Grand River to Lysander	4	iron.
" s. from Brigham 40 ft	6	"
Eighteenth st., from Fort to 50 ft n. of Linden	6	"
" from 50 ft. n. of Linden n. 370 ft	3	"
" from 370 ft. n. of Linden n. 98 ft	4	"
" from 468 ft. n. of Linden to Buchanan	6	"
" from Buchanan to 369 ft. n. of Breckenridge	4	"
" from Grand River to 275 ft. n. of Kirby	6	"
" from McGraw to N. Boulevard	6	"
" alley w. of, n. from Porter	3	wood.
Eighteenth-and-a-half st., s. from River 504 ft	3	iron.
" " from River to Fort	4	"
Elizabeth st., n. and s. sides from alley e. of Woodward to 200 ft. w. of Brush	4	"
" from 200 ft. w. of Brush to Hastings	4	"
" alley s. of, from alley e. of Woodward to Witherell	3	"
Ellery st., from Arndt to Berlin	6	"
" from Forest to Hancock	3	"
Eliot st., from Woodward to Riopelle	4	"
Elm st., from Seventh to alley e. of Trumbull	4	"
" from alley w. of Trumbull to National	4	"
" from Twelfth to Harrison	4	"
" from 100 ft. e. of Thirteenth to alley e. of Wabash	4	"
Elmwood ave., from Jefferson to Croghan	4	"
" from Croghan to Maple	6	"
" from Waterloo to Hunt	4	"
" from Hunt to Gratiot	6	"
Erskine st. from Woodward to Brush	4	"
F st., w. from Vinewood 188 ft	4	"
Farmer st., from Bates to Gratiot	6	"
" from 15 ft s. to 38 ft. n. of 30-inch main in Gratiot	8	"
Farnsworth st., from Woodward to Beaubien	6	"
" from Beaubien to Russell	4	wood.
" from Russell to Grandy	4	iron.
" from Moran to Collins	3 & 4	"
Ferdinand ave., n. from River 975 ft	4	"
" s. from Fort 480 ft	4	"
" n. from Porter 271 ft. n	6	"
" from 360 ft. s. to 309 ft. n. of Dix	6	"
Ferry ave., from Woodward to Russell	4	"
" from Russell to St. Aubin	8	"
" from St. Aubin to 109 ft. e. of Jos. Campau	4	"
" alley s. of, from alley w. of St. Aubin w. 168 ft	2¼	wood.
Field ave., from Kercheval n. 1,558 ft	6	iron.

LOCATION.	DIAM. INCHES.	KIND.
s. of Mack to Hendrie	6	iron.
. to alley n. of Lafayette	4	“
ngress	8	“
se to alley n. of,	4	“
gan to Noble, and on both sides of Elton and Craw-rks	4	“
Holden to 144 ft. s. of Piquette	4	“
rt to Grand River	6	“
rren 348 ft	6	“
to Buchanan	24	“
to Jefferson	6	“
son to alley n. of	8	“
ngress	8	“
bridge to Fort	4	“
o Grand River	6	“
Harper 124 ft	3	“
ft. to 265 ft. n. of Harper	4	“
odward to Cass	4	“
sides, from Cass to Second	4	“
rth to Seventh	4	“
ional to Twelfth	4	“
odward to 324 ft. w. of Rivard	4	“
Russell and Grandy	4	“
pelle to 377 ft. e. of Chene	4	“
randy 225 ft	2¼	wood.
lins to Moran	4	iron.
Elliott to w. of Ellery 124 ft	4	“
ufait w. 157 ft	4	“
f, crossing Orleans	4	“
f, from w. line of Orleans to alley e. of Riopelle	3	“
ard to Griswold	4	“
to Fourteenth	6	“
nth to Hoffman	8	“
n to Twenty-fourth	6	“
-fourth to Artillery	8	“
oine to Mt. Elliott	4	“
ard to Seventh	16	“
n to 168 ft. w	4	“
w. from Brush 135 ft	2¼	wood.
, from Brush to St. Antoine	4	iron.
er to Michigan	6	“
ed to alley s. of Fort	8	“
s. of Fort to Grand River	6	“
nd River to Bagg	4	“
g to Brigham	6	“
ham to Holden	4	“
f, from Selden to alley s. of	4	“
f, from Brainard to alley n. of	4	“
, n. from Tuscola 87 ft	2¼	wood.
Fort to Lafayette	8	iron.
Lafayette to Bagg	10	“
Bagg to Grand River	8	“
Grand River to s. line of N. Boulevard	6	“
le, n. from Porter 500 ft	2¼	wood.
Alexandrine	3	iron.
andrine	4	“

LOCATION.	DIAM. INCHES.	KIND.
Frank st., from Fourth to 114 ft. w. of Sixth	4	iron.
" from 114 ft. w. of Sixth to 75 ft. w. of Fox	3	"
Franklin st., from Randolph to Beaubien	4	"
" from Beaubien to Orleans	6	"
" from Orleans to 25 ft. e. of Dequindre	4	"
" from 25 ft. e. of Dequindre to McDougall	6	"
" from Walker to Adair	4	"
" w. from Leib 310 ft	2¼	wood.
" alley s. of, from McDougall to Walker	4	iron.
" alley n. of, from McDougall to Walker	4	"
Frederick st., from John R to 395 ft. e. of	4	"
" from Beaubien to 203 ft. e. of	4	"
" from Hastings to 306 ft. w. of	4	"
" from 399 ft. w. of Rivard to 178 ft. e. of Russell	4	"
" crossing St. Aubin to alley w. of Dubois	4	"
" from Dubois to Jos. Campau	4	"
" from Helen e. 124 ft	4	"
Front st., from 170 ft. e. of First to Second	4	"
" from Third e. 107 ft	6	"
" alley n. of, from Second to Third	4	"
Gallagher pl., from Crawford to alley w. of Fourth	4	"
Garfield ave., from Woodward to Brush farm	4	"
" from Beaubien to e. line of St. Antoine	4	"
" w. from Hastings 359 ft	3	"
" from Russell to 47 ft e. of Chene	4	"
" from Chene to Grandy	3	wood.
" crossing Grandy	4	iron.
" from Beaufait w. 134 ft	4	"
Goldner ave., from Michigan to G. T. R. R	6	"
Gilbert st., e. from Scotten 368 ft	4	"
Gilman st., from Cass to Grand River	4	"
Grand River ave., from Woodward to Cass	8	"
" from Cass to Third	6	"
" from Third to 400 ft. w. of Humboldt	8	"
" from 400 ft. w. of Humboldt to city limits	6	"
" n. side, e. from Eighth 110 ft	3	"
" from Brigham to Buchanan	30	"
" connecting with 30 main in line of Buchanan, 22 ft	8	"
" alley n. of, w. from Lincoln 47 ft	4	"
" alley n. of, from Lincoln to alley w. of	2¼	wood.
" alley n. of, from Trumbull to alley w. of	6	iron.
Grandy ave., from Gratiot to Pierce	4	"
" from Pierce to Harper	6	"
" n. of Harper 322 ft	4	"
" from 322 ft. n. of Harper to 185 ft. n. of Trombley	6	"
Grant court, from Warren n. 313 ft	4	"
Grant st., crossing Twelfth	4	"
" from Twelfth to Thirteenth	3	"
Granville st., from Thirteenth to Wabash	3	"
" crossing Wabash	4	"
Gratiot ave., from Woodward to Brush	10	"
" from Brush to city limits	6	"
" from Woodward to Raynor	30	"
Green ave., from Holden to Milwaukee	6	"
Griffin ave., from Mitchell e. 68 ft	4	"
Griswold st., from Atwater to State	6	"

LOCATION.	DIAM. INCHES.	KIND.
River to Atwater	8	iron.
of Mullett farm to Orleans	4	"
s to 230 ft. e. of St. Aubin	8	"
to Jos. Campau	4	"
ampau to Walker	6	"
elle	4	"
to 300 ft. w. of St. Aubin	2¼	wood.
ubin 300 ft	3	"
ubin to 275 ft. e	4	iron.
is 162 ft	3	"
o Chene	4	"
Grandy	8	"
to Jos. Campau	2¼	wood.
odward to Oakland	4	iron.
Toledo to s. line of L. S. R. R	6	"
256 ft. s. of Leavitt to 175 ft. n. of Ranspach	6	"
ss to 365 ft. e. of Hastings	4	"
vard to Riopelle	4	"
. Aubin to Dubois	4	"
1 ft. w. of Chene to Grandy	4	"
Mitchell 235 ft	4	"
oran to Collins, 92 ft	4	"
ley w. of Ellery pl. to alley w. of Mt. Elliott	4	"
urth to Trumbull	4	"
tional to 64 ft. w. of Thirteenth	4	"
abash to Fourteenth	3	"
Fourteenth	4	"
enty-fourth to Twenty-fifth	4	"
odward to Russell	4	"
St. Aubin to Dubois	4	"
hene 147 ft	4	"
Grandy 460 ft	2¼	wood.
ndy to Mitchell	4	iron.
rteenth w. 134 ft	4	"
elfth w 176 ft	4	"
lolph to St. Antoine	4	"
chigan to Grand River	4	"
rrick to 343 ft. n. of Kirby	4	"
of, from Linden s. to Linden n	4	"
ction to 500 ft. w. of Campbell	4	"
gress to Clinton	6	"
t. s. of n. line of Jefferson to s. line of same	16	"
erson to Champlain	24	"
ft. s. of Congress to Fort	3	"
mplain to Croghan	3	"
ton to Catherine	4	"
herine to Watson	6	"
tson to Canfield	10	"
field to Forest	8	"
ne of Hancock to n. line of Warren	8	"
Theodore	8	"
nsworth to Ferry	6	"
per to Piquette	6	"
ette to n. line of N. Boulevard	4	"
t. n. of N. Boulevard to Custer	4	"
f, n. from n. line of N. Boulevard, 553 ft	3	"

LOCATION.	DIAM. INCHES.	KIND.
Hastings st., alley w. of, s. from Custer 26 ft	4	iron.
Hazel st., from Harrison to 156 ft. w. of Twelfth	4	“
“ from 156 w. of Twelfth to 96 ft. e. of Thirteenth	3	“
“ e. from Thirteenth 96 ft	4	“
Heck pl., crossing Forest	4	“
“ from Forest to Hancock	3	“
Heidelberg st., crossing Jos. Campau	4	“
“ e. from Jos. Campau 270 ft.	2¼	wood.
“ from 270 ft. to 445 ft. e. of Jos. Campau	3	iron.
“ from alley e. of McDougall to Elmwood	3	“
“ crossing Elmwood 39 ft.	4	“
Helen ave., from Jefferson to Croghan	6	“
“ from Gratiot to s. line of N. Boulevard	6	“
“ crossing Mack	6	“
Hendricks st., from St. Aubin to Dubois	3	“
“ from Dubois to alley w. of McDougall	4	“
“ from alley e. of McDougall to Elmwood	4	“
Hendrie ave., from Woodward to 550 ft. e. of John R.	4	“
“ crossing Grandy	4	“
Henry st., from Woodward to Clifford	4	“
“ from Cass to Third	6	“
“ from Third to alley e. 190 ft.	4	“
Herbert st., from 134 ft. w. of Lovett to Scotten	4	“
High st., from Grand River to Beaubien	4	“
“ from Beaubien to A. Beaubien farm	3	“
“ from L. Beaubien farm to Russell	4	“
“ from Russell to Riopelle	3	“
“ from Grand River to Fourth	3	“
“ from Fourth to alley w. of Trumbull	4	“
“ from alley w. of Trumbull to National	3	“
Hoffman st., from River to Fort	8	“
Holden ave., from Woodward to w. line of Second	6	“
“ from Second to Third	3	wood.
“ from Third to Fourth	4	iron.
“ from Fourth to Crawford	3	wood.
“ from Crawford to Commonwealth	4	iron.
Hooker ave., crossing Grand River to n. 63 ft	4	“
“ from Eighteenth w. 596 st	4	“
Horatio st., from Welch to Livernois	4	“
Horton ave., from Woodward e. 408 ft	4	“
“ from Brush to Oakland	4	“
Howard st., from Tenth to Twelfth	4	“
“ from M. C. R. R. bridge to Twenty-fourth	6	“
“ from Twenty-fourth to Twenty-fifth	4	“
“ e. from Scotten 354 ft.	4	“
Hubbard ave., from Fort to 335 ft. n. of Brandon	6	“
“ from E to Michigan	4	“
“ from Michigan to Myrtle	6	“
“ n. from Myrtle 272 ft	3	wood.
Hudson ave., w. from Crawford 564 ft	4	iron.
“ crossing Grand River 55 ft	4	“
“ from Williams to Twenty-third	4	“
“ w. from Twenty-seventh 340 ft	4	“
Humboldt ave., from Michigan to Butternut	4	“
“ crossing Butternut and Bnchanan	6	“
“ from Butternut to L. S. R. R	4	“
“ from Grand River to Hudson	6	“

LOCATION.	DIAM. INCHES.	KIND.
o Chene	4	iron.
alley w. of McDougall	2¼	wood.
of McDougall to Elmwood	4	iron.
of e. Ellery to Mt. Elliott	4	“
to 295 ft. s.	3	“
to Bagg	2¼	wood.
to 594 ft. w. of Beaubien	3	iron.
en w. 270 ft.	2¼	wood.
ubien and St. Antoine	4	iron.
en to St. Antoine	2¼	wood.
oine to Hastings	2¼	“
tings and St. Aubin	4	iron.
gs to Russell	2¼	wood.
sell to Dequindre	4	iron.
ndre to St. Aubin	2¼	wood.
bin to Grandy	3	iron.
ois and Chene	4	“
r to Jos. Campau	2¼	wood.
gall e. 241 ft.	3	iron.
of McDougall e. 180 ft.	4	“
bien to St. Antoine	3	wood.
Antoine and Hastings	4	iron.
ntoine to Hastings	2¼	wood.
ngs to Rivard	2¼	“
vard and Russell	4	iron.
d to Russell	3	wood.
sson 226 ft.	4	iron.
Jefferson	6	“
rd to Seventh	4	“
en to Lovett	4	“
ty-eighth to Twenty-ninth	4	“
o 44 ft. w. of McDougall	4	“
iswold to Orleans	10	“
stings to Second	16	“
quindre to M. C. Belt Line	6	“
C. Belt Line to Crane	6	“
ldrum to Pumping Works	42	“
swold to First	8	“
f, from alley w. of Wooward to alley w. of Gris-	4	“
f, from Shelby to Cass	4	“
f, from alley w. of Bates to Randolph	4	“
f, from Brush to Beaubien	3	“
f, e. from Beaubien 189 ft.	4	“
of, from alley w. of Bates to St. Antoine	4	“
of, from alley e. of Griswold to First	4	“
of, from First to Third	8	“
quette 473 ft.	3	“
aukee to the N. Boulevard	4	“
n 887 ft.	6	“
to Adams	4	“
s to Columbia	6	“
nbia to Edmund pl	8	“
nd pl. to Erskine	6	“
ot and Rowena	6	“
to Piquette	6	“

LOCATION.	DIAM. INCHES.	KIND.
John R st., n. from Baltimore 250 ft.	3	iron.
" s. from Milwaukee 30 ft.	6	"
Johnson st., e. from Nineteenth 240 ft.	4	"
Jones st., from Cass to 160 ft. w. of Fifth	4	"
" e. from Sixth 240 ft.	3	"
Jos. Campau ave., from Atwater to Clinton	6	"
" from Jay to Waterloo	6	"
" from Cleveland to Gratiot	6	"
" from s. line of Gratiot to St. Joseph	4	"
Jos. Campau ave., from St. Joseph to 80 ft. n. of Forest	6	iron.
" from Theodore to 117 ft. s. of Kirby	6	"
" s. from Ferry 237 ft.	6	"
" from 283 ft. s. of Hendrie to Medbury	6	"
" from Trombley to 250 ft. n. of Milwaukee	4	"
Joy st., from Cass to alley e. of Third	4	"
" from Fourth to Fifth	4	"
Junction ave., from River to Driggs	6	"
" from Fort to 15 ft. s. of Wabash	6	"
" from s. side of Fort to n. of G. T. R. R.	8	"
Kanter ave., from Collins to Moran	4	"
" from Mt. Elliott w. 181 ft.	4	"
Kercheval ave., from Mt. Elliott to Beaufait	4	"
" from Field to Baldwin	4	"
Kinsman st., from Twenty-eighth to Scotten	4	"
Kirby ave., from Woodward to w. line of Cass	4	"
" from Fourth w. 180 ft.	4	"
" from Crawford e. 430 ft.	3	"
" from Crawford to Trumbull	4	"
" from Commonwealth to National	4	"
" from Harrison to 195 ft. w. of Twelfth	4	"
" from Fourteenth w. 126 ft.	4	"
" from Sixteenth to Eighteenth	4	"
" w. from Twenty-seventh 211 ft.	4	"
" crossing John R and Grandy	4	"
" e. from Russell 216 ft.	4	"
" e. from St. Aubin 300 ft.	4	"
" w. from Chene 440 ft.	4	"
" e. from Helen 238 ft.	4	"
Labrosse st., from Fourth to Fifth	4	"
" w. from Tenth 430 ft.	3	"
" e. from Twelfth 550 ft.	3	"
" alley s. of, from alley e. of Fourth to alley e. of Twelfth	4	"
" alley n. of, from Fifth to Eighth	4	"
" alley n. of, from Eighth to Tenth	3	"
Lady's Lane, n. from Dry-dock 214 ft.	4	"
Lafayette ave., from Griswold to Shelby	4	"
" w. from Tenth 743 ft.	4	"
" from 743 ft. w. of Tenth to M. C. R. R. bridge	3	"
" crossing Fourteenth	4	"
" from Fourteenth to Fifteenth	3	"
" from Fifteenth to alley w. of Sixteenth	4	"
" from Twenty-first to Twenty-second	4	"
" from Twenty-third to Twenty-fourth	4	"
" e. from Scotten 288 ft.	4	"
" alley s. of, from Griswold to Shelby	6	"
" alley s. of, from Wayne to First	6	"

LOCATION.	DIAM. INCHES.	KIND.
. of, from First to Fourth	4	iron.
. of, from Fifth to Tenth	4	"
. of, crossing Sixth	6	"
. of, from Shelby to First	4	"
. of, from First to Tenth	6	"
. of, e. from Fourteenth 190 ft	3	"
er to Fort	4	"
t to M. C. R. R.	6	"
wenty-second 240 ft	2¼	wood.
Twenty-second	4	iron.
ft. e. to 562 ft. w. of Crawford	4	"
Twenty-seventh 340 ft	4	"
Fort, 1,968 ft	6	"
k to Toledo	6	"
s to Brush	4	"
ntoine to Dequindre	4	"
elle to St. Aubin	12	"
ubin to Elmwood	4	"
eib 24 ft	4	"
to Mt. Elliott	2¼	wood.
elen 156 ft	4	iron.
d to Hastings	16	"
dward to alley w	8	"
d to Fourth	8	"
th to Fifth	4	"
Michigan 505 ft	6	"
T. R. R. to 400 ft. n. of Nall	6	"
ft. s. to 398 ft. n. of Hancock	6	"
Junction w. 196 ft	4	"
d River to Wabash	4	"
sson to Livernois	4	"
s to Third	6	"
o Jefferson	6	"
n to Champlain	4	"
ain to Croghan	3	"
aubien 206 ft	3	"
bien to Hastings	2¼	wood.
astings and Russell	4	iron.
ings to Russell	2¼	wood.
ell e. 306 ft	2¼	"
elle w. 212 ft	4	iron.
w. of Orleans to 21 ft. e. of Dequindre	4	"
e. of Dequindre to 101 ft. w. of Dubois	2¼	wood.
t w. of Dubois to Chene	3	iron.
hene	4	"
ene 160 ft	3	"
t. e. of Chene to Grandy	2¼	wood.
randy	3	iron.
dy to Jos. Campau	2¼	wood.
os. Campau and McDougall	4	iron.
Campau to McDougall	2¼	wood.
ougall to Collins	3	iron.
t. w. of Moran to Gratiot	4	"
rest 251 ft	3	"
venth to Eighth	4	"
velfth e. 307 ft	3 & 4	"

LOCATION.	DIAM. INCHES.	KIND.
alley w. of, from Charlevoix to Arndt	3	wood.
alley w. of, from Arndt to Berlin	4	iron.
alley w. of, from Berlin to Heidelberg	2¼	wood.
alley e. of, from Mullett to Chestnut	4	iron.
alley e. of, from Waterloo to Preston	3	“
rom Sixteenth to Sullivan	4	“
rom Grand River to Twenty-sixth	4	“
rom LaSalle to Scotten	4	“
., n. from River 875 ft	6	“
from Fort to n. line of Toledo	6	“
crossing Livernois	4	“
from Witherell to John R, n. and s. sides	4	“
alley s. of, from John R to Randolph	4	“
alley n. of, from John R to Randolph	4	“
from Harrison to Thirteenth	4	“
from Thirteenth to Wabash	3	“
from Eighteenth to Sullivan	3	“
from Sullivan to Maybury	4	“
crossing Humboldt and Twenty-fourth	4	“
w. from Twenty-third 190 ft	2¼	wood.
from Twenty-fourth to alley e. of	3	“
from Twenty-seventh to Vinewood	4	iron.
rom Harper to 78 ft. s. of Piquette	4	“
om Gratiot to Orleans	8	“
om Orleans to St. Aubin	4	“
om St. Aubin to Dubois	6	“
rossing Dubois	8	“
rom Dubois to Elmwood	6	“
r. from Fourth 158 ft	3	“
rom 158 ft. e. of Fourth to Crawford	4	“
. from Twelfth 180 ft	4	“
from Woodward to John R	4	“
ve., from Michigan to n. line of Ash	6	“
from Ash to Buchanan	8	“
from Buchanan to L. S. R. R	2¼	wood.
st., from Brush to Beaubien	4	iron.
ve., e. from Woodward 1,070 ft	4	“
crossing St. Aubin	4	“
w. from St. Aubin 730 ft	3	“
w. from Dubois 146 ft	4	“
from 350 ft. w. of Grandy to Jos. Campau	4	“
ve., from Jefferson to Congress	42	“
from Wight to 46 ft. n. of Fort	6	“
from 46 ft. n. of Fort to 360 ft. n. of Kercheval	4	“
from Arndt to Gratiot	6	“
ve., crossing Cass and Second	4	“
from Second to Third	4	“
from Fourth w. 136 ft	4	“
from e. side of Crawford to 136 ft. w. of Fourth	3	“
from e. side of Crawford to Lincoln	4	“
e. from Lincoln 176 ft	3	“
from Trumbull to Twelfth	4	“
w. from Twelfth 214 ft	3	“
from 214 ft. w. of Twelfth to Wabash	3	wood.
from Twenty-seventh to Vinewood	4	iron.
, from Witherell to John R	4	“

LOCATION.	DIAM. INCHES.	KIND.
rrick to 345 ft. n. of Kirby	3 & 4	iron.
eenth to Twentieth	6	“
ndry in Griffin's foundry	3	“
rt to Baker	4	“
ker to Newark	6	“
rth 150 ft	3	“
r. of Fourth to Crawford	4	“
Seventh	4	“
son 283 ft	4	“
rton to Hamlin	6	“
elfth 185 ft	3	“
to e. side Elton Park	4	“
de Elton Park to Sixth	4	“
to Trumbull	6	“
ter to Jefferson	10	“
rson to Reservoir Grounds	8	“
land 57 ft	6	“
andrine to Canfield	6	“
rfield 252 ft	4	“
n. of Garfield to 195 ft. n. of Forest	6	“
bley to Lyman	4	“
ress to Reservoir Basin	24	“
voir to Scott	30	“
eld s. 30 ft	30	“
rteenth 130 ft	3	“
Woodward	4	“
odward to Russell	3	wood.
ssell to 393 ft. e. of St. Aubin	6	iron.
dward to w. line of Brush farm	4	“
ussell and St. Aubin	4	“
ois to Grandy ave	4	“
randy	4	“
n to State	4	“
rd to alley s. of Columbia	6	“
Peterboro	4	“
ward to Cass	4	“
alley e. of Trumbull	4	“
of Trumbull to National	4	“
m alley e. of Trumbull to alley e. of Seventh	4	“
boldt	3 and 4	“
odward to Cass	4	“
ire to St. Aubin	3	“
ubin to 275 ft. e.	4	“
r. of Dubois to Jos. Campau	4	“
ver to National	4	“
to Twelfth	3	“
th	4	“
alley e. of Third	4	“
rth 150 ft	3	“
w. of Fourth to Crawford	4	“
to Seventh.	4	“
dward to Beaubien	4	“
ubien to Hastings	3	“
tings to Russell	4	“
an e. 85 ft	4	“
Elliott w. 250 ft	4	“

LOCATION.	DIAM. INCHES.	KIND.
Piquette ave., from Wabash to Fourteenth	4	iron.
“ from Eighteenth w. 229 ft	4	“
“ from Sullivan e. 158 ft	4	“
Pleasant ave., n. from River 515 ft	4	“
Plum st., from Second to alley e. of Trumbull	4	“
“ from Trumbull to alley e. of	6	“
Plumer st., e. from Junction 436 ft	4	“
“ from Welch to Livernois	4	“
Poplar st., from Wabash to Fourteenth	4	“
“ crossing Thirteenth and Fifteenth	4	“
“ from Tillman to 209 ft, w. of Twenty-third	4	“
“ from Welch e. 82 ft	4	“
Porter st., w. from Twelfth 210 ft	3	“
“ e. from Thirteenth 160 ft	4	“
“ crossing Fourteenth	4	“
“ e. from Fourteenth 172 ft	3	“
“ w. from Eighteenth 130 ft	4	“
“ from alley w. of Eighteenth to Nineteenth	3	wood.
“ from Twentieth to Twenty-first	3	iron.
“ w. from Twenty-first 175 ft	2¼	wood.
“ e. from Twenty-second 225 ft	3	iron.
“ from Twenty-second to Twenty-third	4	“
“ from Twenty-third to Twenty-fourth	2¼	wood.
“ from Twenty-fourth to W. Boulevard, east side	4	iron.
“ e. from Vinewood 27 ft	6	“
“ from Hubbard to Scotten	3	“
“ from McKinstry to Ferdinand	4	“
“ w. from Junction 271 ft	4	“
“ alley s. of from alley e. of Thirteenth 120 ft. w	3	“
Prentiss ave., from Cass to Third	4	“
Preston ave., from Gratiot to Elmwood	3	wood.
“ from Elmwood to Mt. Elliott	4	iron.
Private st., (n. of Ferry ave) from Rivard w. 362 ft	3	“
“ crossing Rivard	4	“
Pulford st., from Meldrum to Beaufait	4	“
from Gratiot e. 165 ft	4	“
Putnam ave., w. from Woodward 60 ft	6	“
“ from 60 ft. of Woodward to w. line of Cass	4	“
“ from Fourth to 58 ft. w. of Seventh	4	“
“ from Lincoln to Twelfth	4	“
Randolph st., from alley s. of Atwater to Jefferson	4	“
“ from Larned to Congress	4	“
“ from Atwater to 24 in. main in Cadillac Square	8	“
“ from Congress to Adams	6	“
“ alley w. of, n. from Atwater	3	“
“ alley e. of, from alley s. of Fort to Champlain	4	“
“ alley e. of, from alley n. of Creghan to Gratiot	4	“
“ crossing Gratiot	10	“
Raynor st., from Clinton to Gratiot	4	“
Ranspach st., from Hammond to Livernois	4	“
Reed pl., crossing Fourth	4	“
“ from Fourth w. 36 ft	4	“
“ from 36 ft. w. of Fourth to Crawford	3	“
“ from Crawford w. 135 ft	4	“
Reeder ave., from Junction to 438 ft. w. of Campbell	4	“
Reservoir grounds., n. of Basin to 30 in. branch	24	“

LOCATION.	DIAM. INCHES.	KIND.
s. and w. sides of Basin	24	iron.
ewood 156 ft	4	“
en to 603 ft. w. of Lovett	4	“
twater to Jefferson	8	“
efferson to Larned	12	“
arned to Adelaide	8	“
delaide to 50 ft. n. of Hancock	6	“
of, s. from Canfield 218 ft.	4	“
twater to Jefferson	8	“
arned to Congress	4	“
fferson to Clinton	10	“
allett to Gratiot	10	“
atiot to Watson	4	“
iot to Warren	4	“
arren to Farnsworth	3	wood.
rnsworth to 221 ft. n. of Ferry.	4	iron.
Piquette	4	“
ey n. of N. Boulevard to Pallister	4	“
d to Fourth	4	“
h to Sixth	4	“
h to e. side M. C. R. R. tracks	8	“
M. C. R. R. tracks 270 ft.	6	“
ne of M. C. R. R. tracks to 525 ft. w. of Twenty-fourth,	8	“
asant to Campau,	8	“
pau to main entrance Exposition grounds	6	“
n into Exposition grounds	4	“
in into Detroit & Lake Superior Copper Works	4	“
erry 325 ft	4	“
teenth to Twentieth	4	“
oodward to Riopelle:	4	“
State 187 ft	4	“
om State 237 ft	6	“
rned to Congress	6	“
ngress to Croghan	4	“
allett to Catherine	8	“
therine to Gratiot	4	“
atiot to Watson	8	“
atson to Canfield	6	“
nfield to s. of Hendrie	10	“
of Hendrie to s. of Piquette	8	“
of Piquette to Pallister	6	“
of, from Chase to Fort	2¼	wood.
enty-first to Twenty-second	4	iron.
nty-third to Twenty-fourth	4	“
alley n. of N. Boulevard to Pallister	4	“
ans to Chene	30	“
elle to St. Aubin	4	“
ubin to Dubois	3	“
ubois	4	“
ubois 190 ft	3	wood.
t. w. of to 499 ft. e. of Chene	3	iron.
hene	4	“
, w. of Grandy to Jos. Campau	4	“
Fort to Dix	6	“
ix to Buchanan	8	“
Buchanan to McGraw	6	“

LOCATION.	DIAM. INCHES.	KIND.
Second st., from Front to alley n. of Jefferson	6	iron.
" crossing Congress st	10	"
" from Abbott to alley s. of	8	"
" from Abbott to Grand River	10	"
" from High to 166 ft. n. of Henry	4	"
Second ave., from Bagg to 30 ft. n. of Prentiss	6	"
" crossing Canfield	8	"
" crossing Forest	6	"
" e. side, crossing Hancock	6	"
" w. side, crossing Hancock	4	"
" e. side, crossing Warren	6	"
" w. side, crossing Warren	4	"
" e. side, crossing Putnam	6	"
" w. side, crossing Putnam	4	"
" e. side, crossing Merrick	6	"
" e. side, crossing Kirby	6	"
" w. side, crossing Kirby	4	"
" e. side, crossing Holden	6	"
" w. side, crossing Holden	4	"
" s. from Holden 1,000 ft	3	wood.
" from Holden to 205 ft. n. of Milwaukee	6	iron.
" alley e. of, from Prentiss to alley n. of Canfield	4	"
Selden ave., from Woodward to Third	4	"
" from Fourth to alley w. of	4	"
" alley s. of, from alley w. of Fourth to Crawford	3	"
" from Sixth to Seventh	4	"
Seventh st., from River to alley n. of Lafayette	8	"
" from alley n. of Lafayette to Bagg	10	"
" from Bagg to Grand River	8	"
" from Grand River to Brigham	6	"
" crossing Brigham	8	"
" from Brigham to 150 ft. n. of Lysander	2¼	wood.
" from 150 ft. n. of Lysander to Warren	6	iron.
" crossing Putnam and Merrick	6	"
" from 214 ft. s. of Kirby to 339 ft. n. of Stanley	6	"
" alley w. of, from alley n. of Pine to Spruce	3	"
" alley w. of, from Perry to alley s. of	4	"
Seventeenth st., from Fort to 28 ft. s. of Poplar	6	"
" from 28 ft. s. of Poplar to s. line of Buchanan	4	"
" from s. line of Buchanan to 20 ft. s. of Hancock	6	"
" s. from Kirby 132 ft.	6	"
Shady Lane, crossing W. Boulevard	4	"
" crossing Vinewood	6	"
Shelby st., from Atwater to Woodbridge	3	"
" from Woodbridge to Jefferson	4	"
" from Woodbridge to Jefferson	8	"
" from Jefferson to Michigan	10	"
" from Lafayette to alley s. of Michigan	4	"
Sheridan ave., from Jefferson to Kercheval	6	"
Sherman st., from Hastings to Elmwood	4	"
Sibley st., from Woodward to Clifford	4	"
Sixth st., from River to alley n	4	"
" from River to Congress	16	"
" from Congress to Abbott	24	"
" from alley n. of Labrosse to Bagg	4	"
" n. from Bagg 88 ft	8	"

LOCATION.	DIAM. INCHES.	KIND.
om 88 ft. n. of Bagg to 473 ft. n. of Grand River	4	iron.
om 473 ft. n. of Grand River to Brigham	6	“
ossing Brigham	6 & 8	“
om Brigham to 265 ft. n. of Lysander	4	“
, from Lafayette to Myrtle	6	“
from Myrtle to Buchanan	8	“
from Buchanan to Grand River	10	“
from Grand River to McGraw	6	“
alley w. of, from Lafayette to Howard	8	“
from Woodward to Oakland	4	“
om Grand River to Noble	4	“
from Cass to Second	4	“
rom Woodward to Cass	4	“
rom Fifth to alley w. of Seventh	4	“
rom alley w. of Trumbull to National	4	“
rom Harrison to Twelfth	4	“
lley s. of, from alley w. of Seventh to alley e. of Trumbull	3	“
pl., from 22 ft. e. of Dequindre to 260 ft. w. of St. Aubin	4	“
w. from St. Aubin 260 ft	3	“
st., from Atwater to Congress	8	“
from Jefferson to Clinton	4	“
from Congress to Gratiot	6	“
crossing Champlain	8	“
from Gratiot to Elizabeth	4	“
from Elizabeth to Adelaide	6	“
from Adelaide to Watson	8	“
from Watson to Farnsworth	6	“
n. from Piquette 445 ft	6	“
from 150 ft. s. to 378 ft. n. of Milwaukee	6	“
ave., from Congress to Champlain	36	“
from Atwater to Harper	6	“
crossing Trombley	6	“
from Larned to Congress	12	“
alley w. of, s. from Ferry 266 ft	2¼	wood.
, e. from Nineteenth 284 ft	4	iron.
st., from Russell to Riopelle	3	“
crossing Riopelle and McDougall	4	“
from Riopelle to 310 ft. e. of St. Aubin	4	“
from 310 ft. e. of St. Aubin to 202 ft. e. of Chene	3	“
from 202 ft. e. of Chene to Grandy	4	“
e. from McDougall 438 ft	3 and 4	“
e., from E. Boulevard to Field	4	“
from Townsend to Baldwin	4	“
., from Seventh to Trumbull	4	“
from Twelfth w. 183 ft	4	“
., from Foundry to Twenty-first	3	wood.
from Welch to Livernois	4	iron.
om Woodward to Washington	30	“
ft. w. of branch in Washington	24	“
om Woodward to Washington	10	“
, from Woodward to Cass	4	“
e., from Michigan to Magnolia	3	wood.
n. from Magnolia 190 ft	3	iron.
crossing Butternut	6	“
from 289 ft. s. to 270 ft. n. of Linden	6	“
s. from Buchanan 288 ft	6	“

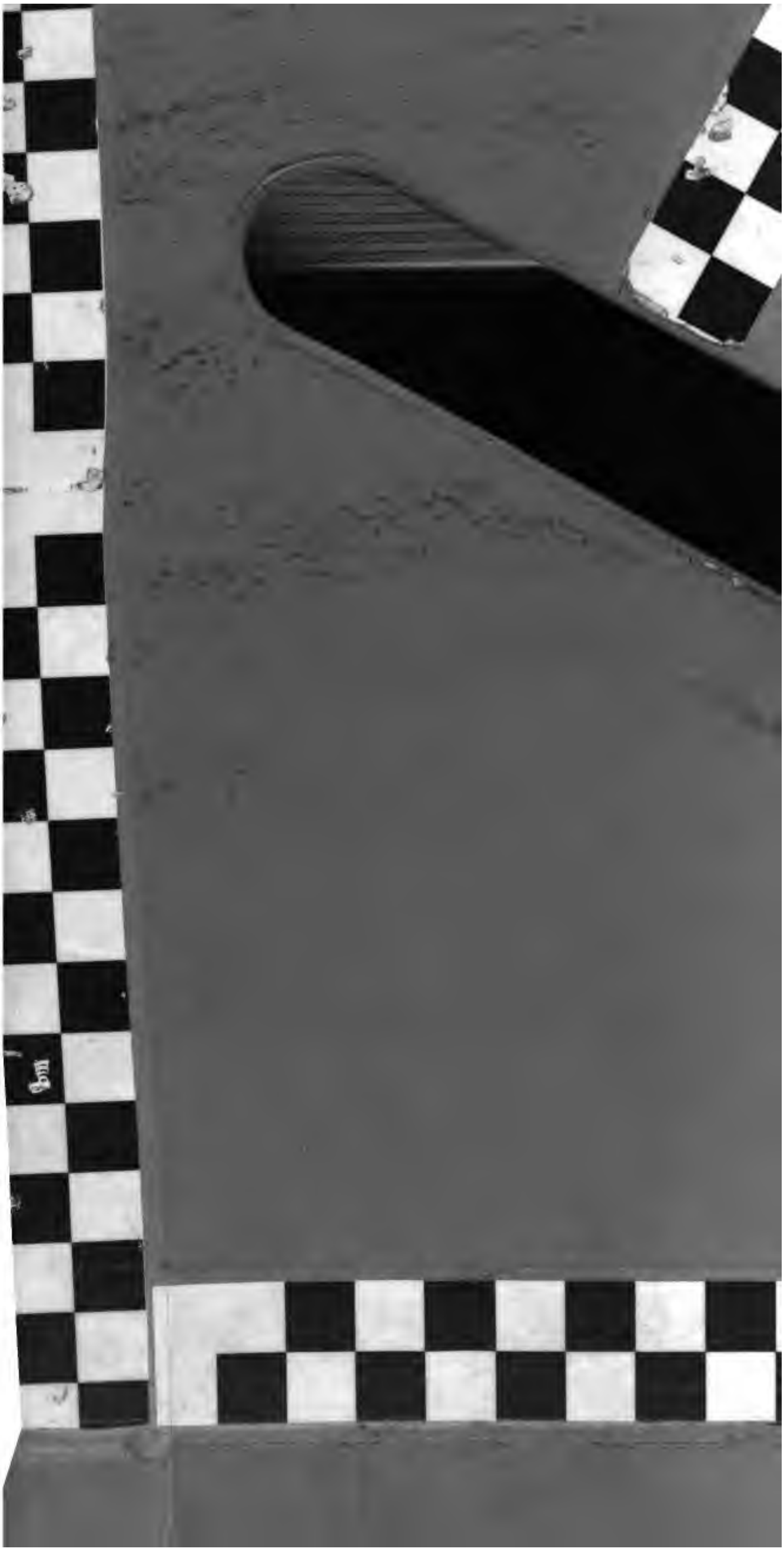
LOCATION.	DIAM. INCHES.	KIND.
Sullivan ave., from McGraw n. 61 ft	6	iron.
" from 104 ft. s. of Piquette to 250 ft. n. of Wreford	6	"
Summit ave., from River to Wabash R. R.	6	"
Superior st., w. from Beaubien 220 ft	4	"
" from Beaubien to Hastings	2¼	wood.
" crossing St. Antoine, Hastings and Russell	4	iron.
" e. from Hastings 359 ft	3	wood.
" crossing Chene and Grandy	4	iron.
" w. from Rivard 437 ft	3	"
" from Rivard to Russell	2¼	wood,
" from Riopelle to Dequindre	4	iron.
" from Dequindre to St. Aubin	2¼	wood.
" from St. Aubin to 343 ft. e. of Chene	3	iron.
" from 197 ft. w. of Grandy to Mitchell	4	"
" from McDougall to Gratiot	4	"
Swain ave., from 40 ft. s. of Wabash R. R. to Fort	6	"
Sycamore st., w. from Grand River 123 ft	6	"
" from alley w. of Trumbull to National	4	"
" from Harrison to Wabash	4	"
Sylvester st., from Gratiot e. 119 ft	4	"
" w. from Mt. Elliott 388 ft	4	"
" from Beaufait to Bellevue	4	"
Tenth st., from River to Baker	8	"
" from Baker to Michigan	6	"
Theodore st., e. from John R 402 ft	4	"
" from 226 ft. w. of Beaubien to e. line of Rivard	4	"
" from w. line of Riopelle to 106 ft. e	4	"
" e. from Russell 450 ft	4	"
" from 268 ft. w. of St. Aubin to 204 ft. e. of same	4	"
" from 477 ft. w. of Chene to Grandy	4	"
Third st., from Front to s. line of River	6	"
" from s. line of River to Larned	8	"
" from Larned to alley n. of	6	"
" from Larned to Fort	24	"
" from Michigan to Grand River	4	"
" from alley s. of Porter to Michigan	3	"
Third ave., from Grand River to Bagg	8	"
" from Brigham to Canfield	30	"
" crossing Brigham 60 ft	8	"
" from Bagg to Holden	6	"
" alley e. of, from Henry to Brainard	4	"
Thirteenth st., from Porter to 112 ft. n. of Elm	6	"
" crossing Myrtle	6	"
" from Magnolia to Grand River	6	"
" n. from Grand River 499 ft	4	"
" from 80 ft s. of, to 150 ft. n. of Hancock	4	"
" alley e. of, s. from Porter 121 ft	4	"
Thirty-first st., from Michigan to 286 ft. s. of Plymouth	6	"
Thirty-second st., from Michigan to 15 ft. s. of Buchanan	4	"
Thirty-third st., from Michigan to 30 ft. n. of Buchanan	6	"
Tillman ave., from Michigan to Breckenridge	6	"
Toledo ave., from 360 ft. e. of Scotten to McKinstry	4	"
" from McKinstry to Junction	6	"
" from 17 ft. e. of Campbell to Livernois	6	"
Trombley ave., from Crystal to St. Aubin	4	"
" from Grandy to 339 ft. e. of Moran	4	"

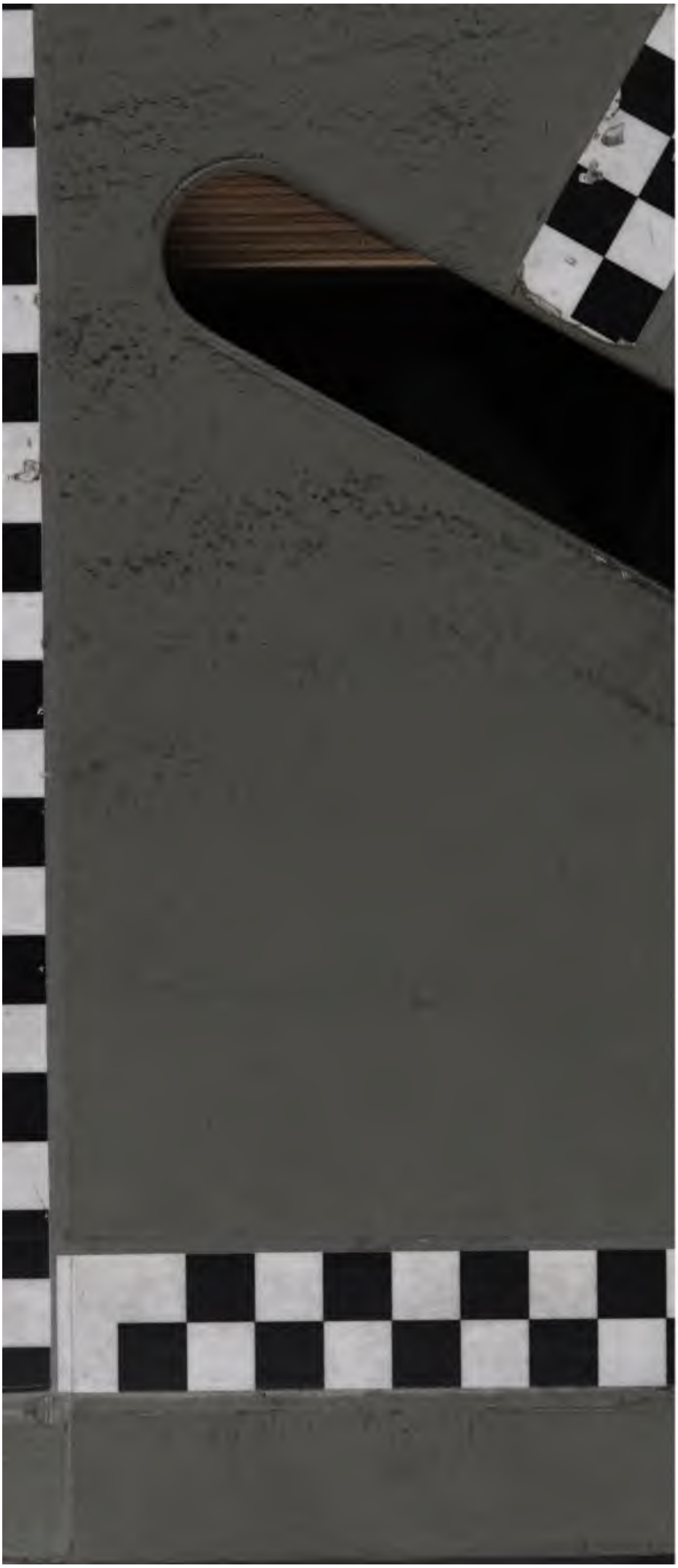
LOCATION.	DIAM. INCHES.	KIND.
ave., from Jefferson to Kercheval	6	iron.
n. from Mack 208 ft	6	"
from 208 ft. n. of Mack to s. line Gratiot	4	"
ve., from Abbott to alley s. of	10	"
from Abbott n. 30 ft	6	"
from Michigan to Plum	6	"
from Grand River to alley n. of	6	"
from Brigham to Forest	8	"
from Forest to 56 ft. n. of	6	"
from 80 ft. s. of Hudson to 298 ft. n. of G. T. Ry	6	"
from Holden to 50 ft. n. of Piquette	6	"
alley e. of, from Plum to Sycamore	6	"
alley w. of, from Cherry to Pine	3	"
alley w. of, from Pine to Myrtle	4	"
alley w. of, from alley n. of Grand River to Brigham	6	"
e. from Fourth 130 ft	2¼	wood.
alley s. of, from Crawford to alley w. of Fourth	4	iron.
alley n. of, from Crawford to alley w. of Fourth	4	"
, from 458 ft. s. of River to Lafayette	4	"
from Howard to Baker	4	"
from Baker to Brigham	6	"
from Brigham to N. Boulevard	8	"
st., from Fort to Michigan	6	"
alley e. of, s. from Rose 197 ft	3	"
t st., from Fort to Baker	4	"
from Baker to Standish	4	"
ond st., from Fort to Dalzelle	6	"
rd st., from Fort to 330 ft. n. of Porter	4	"
from 330 ft. n. of Porter to 419 ft. n. of Dalzelle	3	"
rd st., crossing Baker	4	"
n. from M. C. R. R. 259 ft	3	"
from 259 ft. n. of M. C. R. R. to Magnolia	6	"
from Magnolia to 35 ft. n. of Linden	3	"
from 35 ft. n. of Linden to L. S. R. R	4	"
from Kirby to McGraw	4	"
crossing Butternut, Myrtle and Buchanan	6	"
rth st., from River to Fort	4	"
from Fort to Baker	6	"
from Baker to 20 ft. n. of Michigan	8	"
from 20 ft. n. of, to 54 ft. n. of Michigan	12	"
from 54 ft. n. of, to 96 ft. n. of Michigan	16	"
from 96 ft. n. of, to 181 ft. n. of Michigan	18	"
from 181 ft. n. of, to 236 ft. n. of Michigan	20	"
from 236 ft. n. of Michigan to Butternut	24	"
from Butternut to Buchanan	10	"
from Buchanan to Hancock	8	"
from 50 ft. s. of, to 240 ft. n. of Hudson	8	"
from 240 ft. n. of Hudson to McGraw	4	"
n st., from Howard to Baker	4	"
n. from Dix 1,110 ft	6	"
from 3 ft. s. of E st. to Michigan	4	"
s. from Michigan 730 ft	3	wood.
from Michigan to Linden	6	iron.
n. from Linden 192 ft	3	"
from 595 ft. n. of Buchanan to Hancock	6	"
h st., from E to Lake shore R. R.	6	"

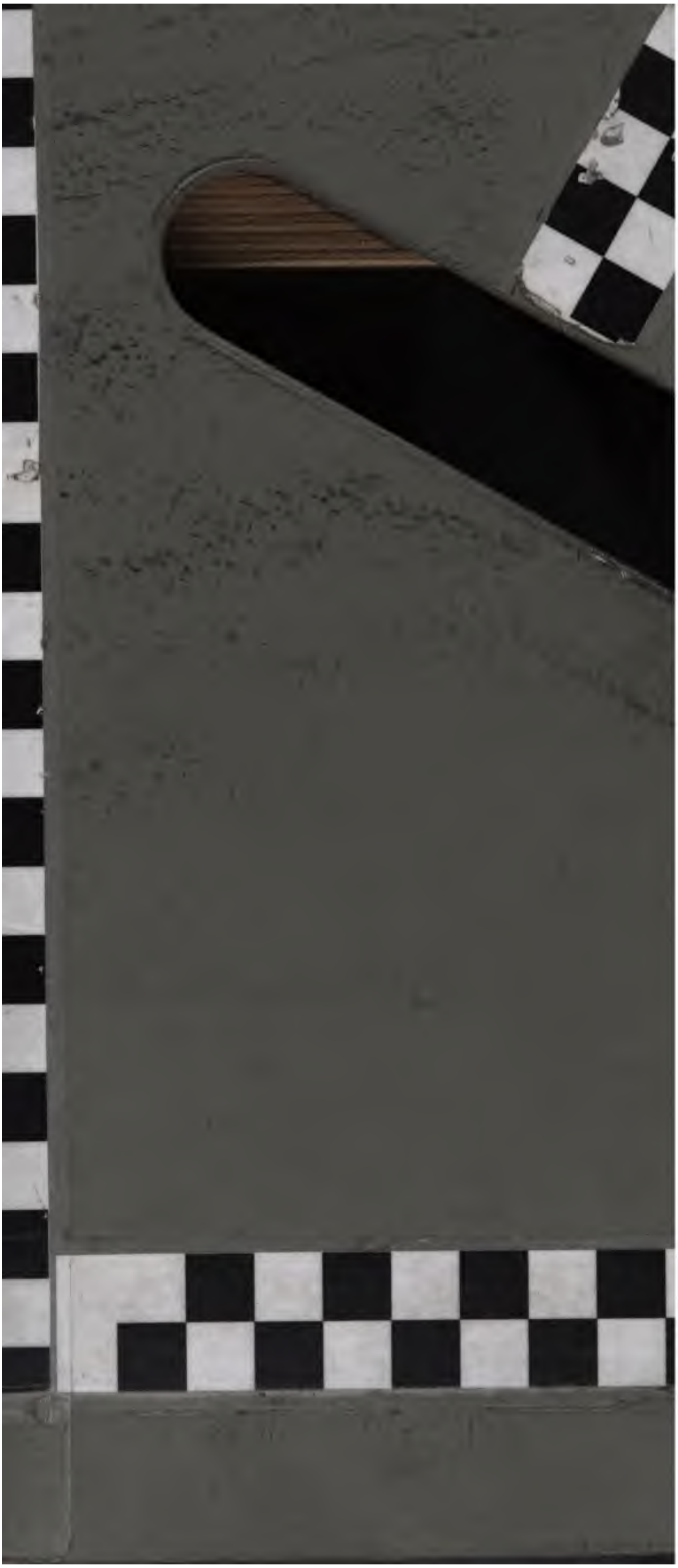
LOCATION.	DIAM. INCHES.	KIND.
Twenty-sixth st., s. from Buchanan 804 ft	6	iron.
" from 176 ft. s. of Kirby to McGraw	6	"
Twenty-seventh st., n. from Dix 990 ft	6	"
" from Michigan to Buchanan	6	"
" from Merrick to Hudson	6	"
Twenty-eighth st., from Michigan to 127 ft. n. of Kinsman,	6	"
Twenty-ninth st., from 565 ft. s. of Michigan to Buchanan	6	"
Uthes ave., from Clark to McKinstry	4	"
Union st., from Fourth to Fifth	3	"
Van Dyke ave., crossing Mack	6	"
Vine st., w. from Fourth 158 ft	3	"
" e. from Fifth 188 ft	2¼	wood.
Vinewood ave., from Fort to Buchanan	24	iron.
" from Fort to 430 ft. n. of Toledo	6	"
" from F to Visgar	6	"
" from Visgar to Nall	3	"
" from Nall to Buchanan	6	"
" from Buchanan to Merrick	10	"
" from Grand River s. 300 ft	8	"
Visgar st., from Vinewood to LaSalle	6	"
Volunteer ave., w. from Junction 315 ft	4	"
Wabash ave., from n. line of M. C. R. R. to Ottawa	6	"
" from Ottawa to Lysander	4	"
" from Lysander to Lake Shore R. R.	2¼	wood.
" from s. line Lake Shore R. R. to 186 ft. n. of Piquette	6	"
" from Magnolia to Hazel	2¼	wood.
" alley e. of, from 135 ft. s. of Butternut to Myrtle	2¼	"
" alley e. of, crossing Myrtle.	4	iron.
Walker st., from Atwater to Jefferson	4	"
Warren ave., from w. line of Cass to 105 ft. e. of Riopelle	4	"
" from St. Aubin to 211 ft. e. of Dubois	4	"
" crossing Grandy	4	"
" from Second to Third	4	"
" from Fourth to Crawford	2¼	wood.
" from Crawford to 106 ft. w. of Seventh	4	iron.
" from National to 194 ft. w. of Twelfth	4	"
" from Fourteenth to Sixteenth	4	"
Washington ave., from Michigan to State	30	"
" from Michigan to Grand River	10	"
" alley w. of, from alley n. of Michigan to alley s. of Park	4	"
" alley e. of, from alley n. of Michigan to alley s. of Park	4	"
Waterloo st., from Gratiot to Jos. Campau	4	"
" from alley e. of McDougall to Elmwood	4	"
" e. from Elmwood 562 ft	3	"
" from 562 ft. e. of Elmwood to w. line of Burlage pl	4	"
" from Mt. Elliott to 57 ft. e. of Beaufait	4	"
Watson st., from Brush to Reservoir	24	"
" from Woodward to Brush	4	"
" from Dequindre to St. Aubin	2¼	wood.
" crossing St. Aubin, Dubois and Chene	4	iron.
" from St. Aubin to Dubois	2¼	wood.
" from Dubois to Chene	2¼	"
Wayne st., from Woodbridge 173 ft	4	iron.
" from Woodbridge to Michigan	6	"

LOCATION.	DIAM. INCHES.	KIND.
pl., e. from Nineteenth 276 ft	4	iron.
e. from Twenty-second 240 ft	2¼	wood.
ve., from Plumer to s. line of M. C. R. R	6	iron.
from 211 ft. s. to 225 ft. n. of Stark.	6	“
534 ft. s. of Michigan to the city limits	6	“
ave., from Toledo to L. S. R. R.	6	“
from G. T. R. R. to Leavitt	6	“
from D. L. & N. R. R. to 190 ft. n. of Herbert	6	“
st., from Chene to Leib	4	“
from Leib to 110 ft. e. of Meldrum	6	“
alley s. of, e. from McDougall 230 ft	4	“
s st., from Brush to Russell	4	“
from 158 ft. w. of Riopelle to Dequindre	4	“
e. from Dequindre 540 ft	2¼	wood.
from e. line to 172 ft. w. of St. Aubin	4	iron.
from St. Aubin to Dubois	3	wood.
crossing Dubois	4	iron.
e. from Dubois 225 ft	3	wood.
w. from Chene 375 ft.	2¼	“
ams ave., from Michigan to 65 ft. s. of Breckenridge	6	iron.
from 140 ft. n. of Kirby to Hudson	6	“
s ave., from Woodward to Beaubien	4	“
“ from Beaubien to St. Antoine	3	“
“ e. from St. Antoine 296 ft	2¼	wood.
“ w. from Hastings 350 ft	3	“
“ e. from Hastings 356 ft	4	iron.
“ alley n. of, crossing Hastings	4	“
“ alley n. of, from Hastings e. 331 ft	3	“
“ w. from Rivard 332 ft	3	“
“ e. from Rivard 320 ft	3	wood.
“ w. from Russell 36 ft	3	iron.
“ from w. line of Russell to Dequindre	4	“
“ from Dequindre to St. Aubin	2¼	wood.
“ crossing St. Aubin and Chene	4	iron.
“ from St. Aubin to 80 ft. e. of Dubois	3	wood.
“ w. from Chene 537 ft	3	iron.
“ from Chene to Grandy	3	“
“ from Jos. Campau to Mitchell	2¼	wood.
“ crossing Mitchell	4	iron.
“ from Mitchell to McDougall	2¼	wood.
“ from McDougall e. 291 ft	4	iron.
“ e. from Collins 146 ft	4	“
“ from Woodward to Third	6	“
“ from Fourth to Crawford	4	“
“ from Sixth to Eighth	4	“
“ e. from Twelfth 215 ft	3	wood.
“ crossing Twelfth	4	iron.
Winder st., from Woodward to Orleans	4	“
Wing pl., e. from Nineteenth 220 ft	2¼	wood.
Winter st., from Dequindre 431 ft	4	iron.
Witherell st., from Woodward to Miami	6	“
“ from Miami to Adams	4	“
“ from Adams to alley n. of	3	“
Woodbridge st., from Randolph to Brush	4	“
“ alley s. of, from Bates to Randolph	4	“
“ alley s. of, from Brush to A. Beaubien farm	3	“

LOCATION.	DIAM. INCHES.	KIND.
Woodbridge st., from L. Beaubien farm to St. Antoine	3	iron.
" from St. Antoine to Rivard	4	"
" from Rivard to Russell	3	"
" from Russell to Orleans	4	"
" from Orleans to 271 ft. e. of St. Aubin	6	"
" w. from Jos. Campau 300 ft	2¼	wood.
" from Jos. Campau to 112 ft w. of McDougall	4	iron.
" w. from Leib 310 ft	2¼	wood.
" crossing Woodward	8	iron.
" from Woodward to Griswold	6	"
" from Griswold to First	4	"
" from First to Second	6	"
Woodward ave., from Atwater to Jefferson	16	"
" from Jefferson to Soldiers' Monument	24	"
" e. side, s. from Atwater 246 ft	3	"
" w. side, s. from Atwater 171 ft	4	"
" from Atwater to Adams	8	"
" from Adams to Baltimore	10	"
" from Baltimore to Pallister	8	"
" from High to 200 ft. n. of Canfield	4	"
" from Bagg to Edmund pl	24	"
" alley e. of, from alley s. of Atwater to alley s. of Jefferson	4	"
" alley e. of, from alley n. of Jefferson to alley n. of Congress	4	"
" alley e. of, from Gratiot to alley s. of	6	"
" alley e. of, from Gratiot to alley s. of Witherell	4	"
" alley e. of, from Elizabeth to alley s. of	3	"
" crossing Elizabeth	4	"
" from Columbia to Montcalm	4	"
" alley w. of, from Atwater to alley s. of Jefferson	4	"
" alley w. of, from alley n. of Jefferson to Larned	4	"
" alley w. of, from Larned to Congress	8	"
" alley w. of, from Congress to alley n. of	4	"
" alley w. of, from alley n. of Michigan to alley s. of Park,	4	"
Wreford ave., from Grand River to 93 ft. e. of Sullivan	4	"







THIRTY-EIGHTH

NNUAL REPORT OF THE

D OF WATER COMMISSIONERS

NEW WATER WORKS.

TO THE

MMON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR

1889.

Calvert Lith. Co. Detroit Mich.

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THIRTY-EIGHTH ANNUAL REPORT

OF THE

oard of Water Commissioners

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

TOGETHER WITH THE

ORTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1889.

COMPANY.

DETROIT WATER RATES.

From July 1, 1886.

	PER ANNUM.
For Family	$5 00
Green Houses.—Special rates.	
Private Stables, for each horse	2 00
Livery Stables, “ “ “	2 00
Dray and Team Horses, each	1 00
Cows, each	1 00
Stores and Offices, from	$2 00 to $20 00
Bakeries, average daily use, for each bbl. of flour	3 50
Saloons, Groceries and Provision Stores, from	$3 00 to 100 00
Bar, with faucet, from	8 00 to 50 00
Fish Houses	10 00 to 100 00
Slaughter Houses.—Special rates.	
Hotels and Taverns, in addition to family rate, each room	1 00
Boarding Schools, each room	1 00
Public Schools, from	$5 00 to 50 00
Building Purposes, each 1 M brick	5
“ “ “ 100 yards plastering	10
“ “ “ perch stone	1½
Printing Offices.—Special rates.	
Butcher Stalls, each not less than	3 00
Work Shops, for 10 persons or under	3 00
“ “ for each additional 10 persons	1 00
Estimated quantities of water each 100 gals	2
Meter Rates, each 100 gals., for first 5,000 cubic feet, monthly,	1
“ “ all over 5,000 cubic feet, each month	⅔
Boarding Houses, in addition to family rate, each boarder	1 00

FIXTURES.

Bath Tubs, for families, 1st tub, $2 00; each additional	1 00
Bath Tubs, public, each tub	5 00
Water Closets, for a family, 1st closet, $3 00; each additional, $2 00.	$3 00 to $15 00
Water Closets for Hotels, Stores, Factories, &c., for 10 persons, $5 00; each additional person	25
Water Closets, not automatic, not less than	6 00
Urinals, not less than	2 00
Wash-Hand Basins, for family	$1 00 to 3 00
“ “ “ “ other purposes, each person	25
Permanent Wash Tubs	2 00
Hose	$3 00 to 30 00
Fountains	5 00 to 20 00
Street Sprinklers, each wagon	$200 00

Where there is waste of water a proper increase of rates will be made.

PORT OF THE COMMISSIONERS.

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REPORT OF THE COMMISSIONERS.

WATER COMMISSIONER'S OFFICE.

DETROIT, January 2, 1890.

ommon Council of the City of Detroit:

Board of Water Commissioners respectfully submit
nnual report for the year ending December 31, 1889.
the financial transactions and condition of the Works,
r the work performed in the Meter and Inspection
ment, your attention is called to the report of the Sec-
for the work performed in the department of Exten-
nd Construction to that of the Superintendent of that
ment; and for the details of the supply of water to that
Mechanical Engineer, all of which accompany this

Secretary has already presented your honorable body
detailed statement of all of our expenditures for the
hich statement comprises the number of the vouchers,
nes of the parties of whom the purchases are made, the
of the articles purchased and the amounts paid there-
he original bills and vouchers are on file in this office.
bonded indebtedness of the Board is but little changed
ur last annual report. In the month of January, one
f $1,000 was presented and paid, of the issue payable
t 1, 1888. The indebtedness is now $1,326,000 with an
interest upon the same of $83,330, of which bonds
will mature the first of August the present year.
total expenditures for the year were $313,307.02, and
eipts were $482,663.45, an excess of the latter over the
of $169,356.43.
28 miles of iron water pipe have been laid the past
t an expenditure of $100,658.18, the largest portion of

which was in the new territories of the city. The residents of these portions of the city, the majority of whom have until very recently continued the use of water from shallow wells, to which your attention was called in our last annual report, are being rapidly forced to the use of water from the Works by reason of the sewers draining their wells.

The question of a new settling basin at the pumping works has received careful consideration, and a determination arrived at to enter at once into arrangements for its construction. The Superintendent has received instructions to prepare plans and specifications therefor, and present them to the Board at its next regular meeting.

It is no doubt well known to your honorable body and to our fellow citizens generally, that the decision of Judge Hosmer in the Circuit Court, sustaining the will of Chauncey Hurlbut, the late President of the Board, was unanimously affirmed by the Supreme Court of the State.

Another suit has been commenced by the Administrator of Mrs. Hurlbut's estate for the possession of $40,000 of bonds, which it is claimed belongs to her estate. As soon as a decision is obtained in this matter there will be nothing to interfere with carrying out the provisions of the will, except such legal steps as are necessary to take and as are required under the will, of the Trustees, Jerome Croul, James E. Pittman and William C. Colburn.

The people of Detroit have much reason to congratulate themselves upon the successful issue of this litigation; they have reason to congratulate themselves in having had so long among them a man, whose life became more and more devoted, as the years passed by, to their interests and to the prosecution of this branch of their public works; and they have reason to congratulate themselves that he has left, for the benefit of his fellow citizens, practically all of the large estate which he had accumulated by long years of patient and economical industry.

It is the earnest desire of your Commissioners to carry out the wishes of Mr. Hurlbut, both as expressed and implied, and

of the grounds around the pump
ttached thereto, as he expressed it
be creditable to the city and agreea
rs."

ive at various times, in our annual reports and th
s, called attention to the extravagant waste of water
lly going on in the city, and which finally became
rger than that of any other city in the United States
e exception.

the experience of all water works that, without any
ons, the waste of water increases much more rapidly
e population. In 1878 the average daily *per capita*
n Detroit was 105 gallons, and in 1888, ten years there-
is supply had increased to 175 gallons.

doption of some stringent measures for the prevention
rapidly increasing waste has not appeared necessary to
mmissioners previous to the winter of 1888-9.

xtension of the Works to its present proportions was,
pinion, absolutely demanded, not so much for the pur-
providing for the growing wants of an increasing
ion, as it was to establish a duplicate system of supply,
regards the pumping power at the Works, and the
pply mains leading therefrom into the city.

necessity for this duplicate system of supply has been
demonstrated the past year, first in the breakage
ng in the engines themselves on two different occasions
cond, the bursting of one of the two 42-inch supply
in September last. Had it not been for the establish-
f this duplicate system, the city would have been com-
deprived of water at the times of these several acci-

ing then this large capacity for supply, the Board has
before remarked, heretofore deemed it necessary to
measures to stop the waste, knowing that such measures
ecessarily be expensive as well as annoying to water

ing the last winter, however, so extravagant had this

Lita

THIRTY-EIGHTH ANNUAL REPORT

OF THE

ard of Water Commissioners

TO THE

COMMON COUNCIL OF THE CITY OF DETROIT

TOGETHER WITH THE

RTS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1889.

DETROIT:
THE DETROIT FREE PRESS PRINTING COMPANY.
1890.

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PORT OF THE COMMISSIONERS.

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REPORT OF THE COMMISSIONERS.

WATER COMMISSIONER'S OFFICE.

DETROIT, January 2, 1890.

ommon Council of the City of Detroit:

Board of Water Commissioners respectfully submit
nnual report for the year ending December 31, 1889.

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r the work performed in the Meter and Inspection
ment, your attention is called to the report of the Sec-
; for the work performed in the department of Exten-
nd Construction to that of the Superintendent of that
ment; and for the details of the supply of water to that
Mechanical Engineer, all of which accompany this

Secretary has already presented your honorable body
detailed statement of all of our expenditures for the
hich statement comprises the number of the vouchers,
mes of the parties of whom the purchases are made, the
of the articles purchased and the amounts paid there-
e original bills and vouchers are on file in this office.

onded indebtedness of the Board is but little changed
r last annual report. In the month of January, one
$1,000 was presented and paid, of the issue payable
1, 1888. The indebtedness is now $1,326,000 with an
interest upon the same of $83,330, of which bonds
will mature the first of August the present year.

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ipts were $482,663.45, an excess of the latter over the
f $169,356.43.

28 miles of iron water pipe have been laid the past
an expenditure of $100,658.18, the largest portion of

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28 miles of iron water pipe have been laid the past an expenditure of $100,658.18, the largest portion of

RESERVOIR ACCOUNT:		
Labor, repairs and materials for	$850 34	
Tools and materials	25 95	
Superintendent	456 25	
Coal	23 00	
		$1,355 54
OFFICE ACCOUNT:		
Secretary, assessors and clerks	$14,779 22	
Printing, advertising, etc	1,148 10	
Alterations and repairs	1,618 70	
Supplies, soap, matches, etc	71 22	
Supplies, ink, books, furniture etc	685 92	
Insurance	232 48	
Extra services	334 80	
Fuel	652 37	
Gas	150 50	
Postage and street car tickets	94 10	
Attorney	600 00	
Expert examiners	40 00	
Watchmen	1,037 50	
Counterfeit money	16 00	
		$21,460 91
SERVICE COCKS ACCOUNT:		
Labor	$5,607 20	
Tools and repairs of	121 90	
Corporation stops	2,243 25	
		7,972 35
HORSE AND WAGON ACCOUNT:		
Farrier	$196 58	
Feed	573 62	
Repairs	297 37	
Labor	1,300 00	
Vehicles, harness, etc	372 88	
		2,740 45
PERCENTAGE ACCOUNT:		
Labor, shutting off		1,195 00
INSPECTION ACCOUNT:		
Examiners salaries	$3,979 85	
Printing	61 40	
		4,041 25
Total operating expenses		$102,587 07

HURLBUT FUND.

Labor	$227 25	
Tools	50	
Iron pipe and other materials	477 28	
Trees, etc	3 55	
Librarian	300 00	
Cleaning library	16 00	
		$1,024 58

RECAPTULATION.

expenses	$102,587 07
n	133,355 37
bonded debt	75,340 00
	1,000 00
nd	1,024 58
gregate expenditures for 1889	$313,307 02

STATEMENT.

nd January 1, 1889	$85,488 46	
r the year	482,663 99	
		$568,152 45
n 1889	$313,307 02	
nd January 1, 1890	254,845 43	
		$568,152 45

orable Board of Water Commissioners of the City of Detroit:

MEN—We have carefully examined the vouchers and the Water Works from January 1st to December , and find them correct.

nd in office	$ 1,897 19
k, condition general fund	232,273 60
k, condition sinking fund	20,674 64
Total January 1st, 1890	$254,845 43

is correct.

Respectfully submitted,
D. R. PEIRCE,
JOHN HOSMER,
Committee.

WATER RATES.

Assessment for the Year 1889–1890.

WARDS.	Families.			Tenements Vacant.	Increase Assessed.	Assessment.		
	Assessed.	Not Assessed.	Whole Number.			1889-90.	Increase or Decrease.	$ reduced by use of meters.
1st Dist.—								
Seventh	2,730	4	2,734	18	92	$20.882	—1,062	$1,938
Ninth............	4,050	10	4,060	14	204	25,187	+1,010	642
Total	6,780	14	6,794	32	296	46,069	— 52	2,570
2d Dist.—								
Third............	2,941	3	2,944	54	47	22,098	+ 833	....
Fifth............	3,270	2	3,272	52	98	22,077	—2,944	3,798
Total..........	6,211	5	6,216	106	145	44,175	—2,111	3,798
3d Dist.—								
First............	2,241	.....	2,241	53	53	39,081	+ 506	752
Second	1,989	......	1,989	63	—1	44,137	— 507	1,247
Total	4,230	......	4,280	116	52	83,218	— 1	1,999
4th Dist.—								
Fourth.	2,606	......	2,606	80	43	27,805	+ 650	419
Sixth............	3,019	4	3,023	68	137	23,482	+1,353	168
Total	5,625	4	5,629	148	180	51,287	+2,003	587
5th Dist.—								
Eighth...........	2,666	7	2,673	33	113	19,835	+ 399	674
Tenth............	3,363	14	3,377	44	163	23,037	+ 306	396
Total	6,029	21	6,050	77	276	42,872	+ 705	1,070
6th Dist.—								
Twelfth	2,453	12	2,465	25	106	16,525	— 111	726
Fourteenth......	1,450	242	1,692	14	373	14,248	+2,837	6
Sixteenth........	967	653	1,620	25	289	5,987	+1,571	....
Total	4,870	907	5,777	64	768	36,760	+4,297	732
7th Dist,—								
Eleventh	2,727	7	2,734	11	166	17,294	+1,065	84
Thirteenth.......	1,614	5	1.619	4	198	10,607	+ 940	....
Fifteenth..... ..	1,009	35	1,044	4	203	7,048	+1,443	80
Hamtramck.....	63	......	63	....	11	1,538	+ 237	....
Total	5,413	47	5,460	19	578	36,487	+8,685	164
Aggregate.....	39,158	998	40,156	562	2,295	$340,868	+8,526	10,920

ssessment was made in May and June, to commence 1889. The amount thereof was $340,868, which increase of only $8,526 over that of the year previ- is is accounted for by the fact that a number of places, rmer assessment, as shown by the tabular statement, ed the sum of $10,920, were dropped from the assess- s, on account of meters being placed thereon.

ıtes collected during the year ending December 31, ıs $367,925.27, including receipts from meters, an ›ver that of 1888 of $23,610.01, and were as follows:

RECEIPTS OF WATER RATES.

t ct.	Second District.	Third District.	Fourth District.	Fifth District.	Sixth District.	Seventh District.	Aggregate.
00	....	....	....	....	....	....	$6 00
..	$11 75	... ...	....	....	....	....	11 75
....	17 25	....	$2 25	....	....	....	19 50
. 25	6 25	$13 25	5 00	....	....	....	25 75
25	83 25	158 75	96 25	$49 50	$43 75	....	466 75
12	23,511 31	42,216 23	26,010 74	32,511 96	26,942 88	....	174,510 24
49	25,640 88	48,006 19	27,677 55	23,312 63	22,421 97	$20,176 57	192,885 28
11	$49,270 69	$90.394 42	$53,791 79	$55,874 09	$49,408 60	$20,176 57	$367,925 27

The following is an exhibit of the assessments and collections for the several years in the history of the Board—the former commencing in July and the latter in January of each year:

Year.	Assessment.	Collection.	Year.	Assessment.	Collection.	Year.	Assessment.	Collection.
1853	$28,617	$25,482 48	1866	$83,641 00	$83,044 80	1878	$203,229 00	$208,193 95
1854	31,340	27,290 58	1867	96,678 00	98,428 18	1879	208,666 00	218,110 18
1855	36,184	34,192 80	1868	105,752 00	106,399 14	1880	220,538 00	227,452 78
1856	40,640	26,031 94	1869	115,252 00	113,068 29	1881	233,657 00	241,844 32
1857	44,344	37,666 25	1870	130,301 00	127,143 61	1882	253,583 00	261,725 79
1858	53,339	40,942 20	1871	141,003 00	138,325 87	1883	270,019 00	280,049 06
1859	55,790	48,779 04	1872	151,928 00	155,536 98	1884	293,998 00	300,467 24
1860	56,869	49,434 90	1873	168,247 55	167,022 00	1885	298,860 00	313,205 10
1861	60,507	54,760 01	1874	182,308 75	183,323 27	1886	286,979 00	314,954 21
1862	64,128	57,655 82	1875	195,110 75	195,908 64	1887	312,324 00	332,834 59
1863	77,003	68,098 98	1876	208,876 50	205,624 74	1888	332,342 00	344,315 26
1864	80,124	83,155 42	1877	205,603 00	210,288 12	1889	340,868 00	367,925 27
1865	77,212	84,041 21						

BONDED INDEBTEDNESS.

The following is a statement of the present bonded debt:

AMOUNT.	ISSUED.	PAYABLE.	Rates of Interest.	Annual Interest.
$97,000 00	August 1, 1855	August 1, 1890	7%	6,790 00
46,000 00	August 1, 1858	August 1, 1893	7%	3,220 00
50,000 00	August 1, 1859	August 1, 1893	7%	3,500 00
50,000 00	August 1, 1860	August 1, 1893	7%	3,500 00
50,000 00	Dec'r 1, 1881	Dec'r 1, 1896	4%	2,000 00
100,000 00	Sept'r 1, 1880	Sept'r 1, 1899	4%	4,000 00
100,000 00	April 1, 1881	April 1, 1899	4%	4,000 00
100,000 00	Feb'ry 1, 1870	Feb'ry 1, 1900	7%	7,000 00
50,000 00	August 1, 1872	August 1, 1902	7%	3,500 00
50,000 00	August 1, 1873	August 1, 1903	7%	3,500 00
44,000 00	Feb'ry 1, 1874	Feb'ry 1, 1904	7%	3,080 00
241,000 00	August 1, 1874	August 1, 1904	7%	16,870 00
149,000 00	June 1, 1875	June 1, 1905	7%	10,430 00
199,000 00	June 1, 1876	June 1, 1906	6%	11,940 00
$1,326,000 00				$83,330 00

NEW PUMPING WORKS.

ount expended for the new works to January 1, 1890, ws:

ITEMS.	EXPENDED PREVIOUSLY.	1889.	TOTAL.
....	$ 35,000 00	....	$ 35,000 00
ns.................	608,677 14	$737 63	609,414 77
....	51,356 97	....	51,356 97
in and canals..	123,912 78	5,496 34	129,409 12
nd conduit wells....	44,203 97	....	44,203 97
iler and coal houses.	159,871 90	....	159,871 90
and tower.........	30,420 72	....	30,420 72
ls................	54,221 56	....	54,221 56
....	265,642 24	....	265,642 24
....	44,248 40	....	44,248 40
house	7,773 14	....	7,773 14
....	3,666 25	....	3,666 25
....	45,192 70	1,790 83	46,983 53
....	2,977 86	....	2,977 86
ous....	8,730 95	....	8,730 95
	$1,485,896 58	$8,024 80	$1,493,921 38

SINKING FUND.

s now in the Commercial National Bank to the credit nking Fund $20,674.64; to which must be added the 24,277.30 in accordance with the act authorizing the 0 loan of 1873.

that portion of the amount paid to the Board from Treasury which the said act requires to be placed in ng Fund for the payment of outstanding indebted-

INSPECTION.

The following table shows the work performed by the Inspectors, in connection with which they have discovered 490 places where hose was being used and had the same placed on the Assessment rolls.

	Calls for Non-payment.	Shuts for Non-payment.	Examined New Connections.	Let on New Connections.	Shuts for Building Tax.	Notified for Building Tax.	Shuts Vacancy, New Buildings.	Shuts Vacancy, Old Buildings.
John Wallace	561	300	957	1,034	5	94	113	60
John Hatzenbuhler	436	364	803	685	......	86	162	......
Michael Hart	720	590	548	344	9	87	106	30
John Becker	1,205	604	603	371	2	105	87	45
	2,922	1,858	2,911	2,434	14	372	468	135

PREVENTION OF WASTE AND METER DEPARTMENT.

On the 6th of March last the Board instructed by resolution the Superintendent and myself to inaugurate some system for the prevention of the rapidly increasing waste, and authorizing us to adopt such reasonable and lawful measures as seemed best to us.

Immediately thereafter a corps of eight examiners were organized whose general duties were the inspection of premises. It was my first idea that to disarm the public of a natural tendency to opposition and to induce them to co-operate with us would avail more to the accomplishment of the result desired by the Board than any other action. Pursuant to this idea a circular was prepared, stating concisely the condition of our water supply, the inordinate and increasing waste, and asking the people to join with and assist us rather than place themselves in opposition to us.

The first task of the examiners was the distributing of these

into every household, workshop, store, office and fac·
such was the effect of this appeal that the quantity
pumped rapidly decreased to very near 2,000,000
day less than the corresponding days of the previous

xt duty imposed upon the examiners was the exami-
all service pipes and the openings therefrom, in their
istricts. 3,145 leaks and 394 running streams were
d caused to be repaired or discontinued, the result of
s to further decrease the quantity of water pumped.
this work was completed, mindful of the fact that the
quantity required was in winter when thousands of
ers permitted the water to run to prevent freezing,
ircular was prepared and placed in the hands of every
ccupant or agent of every piece of property in the
ing what the effect of such practice was, and that, in
g winter it would not be permitted, and cautioning
t, if the condition of their plumbing was such as to
running stream, they must have it attended to and
proper condition before the winter months. I am
, however, that, although many acted upon the warn-
here are many more who have disregarded the notice
ough carelessness or actual defiance of the Board. A
vatchfulness and house to house inspection will be
ed during the present winter, and all premises on
e found running streams, will be shut off after warn-
s such streams have been previously paid for.
xt duty performed by the Examiners, and which is
mpleted at the close of the year, was the examination
ff boxes, and the requiring the owners of property to
ith the regulations of the Board in this regard; 6,903
ve already been repaired or replaced.
same time that this corps of Examiners were organ-
parations were made for the placing of meters upon
of partial or indefinite supply. This has resulted in
rs of various sizes of the following description being

placed the effect of which was to very largely decrease the quantity of water pumped :

KIND.	SIZES.							Aggregate.
	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	
Crown........	30	10	44	8	12	8	3	
Hersey.......	4	—	17	—	5	2	2	
Worthington .	9	3	10	—	4	3	2	
Union........	4	—	4	—	3	2	1	
Thomson.....	2	—	1	—	1	—	—	
Totals......	49	13	76	8	25	15	8	194

The utmost care has been used that both the Examiners and also the men engaged in the placing of meters should always be courteous, and under no circumstances to be drawn into angry altercations, or be guilty of overbearing or abusive language. I am pleased to report that I have not received one single complaint during the whole year of any of these employees violating this order.

The result of this work, in reducing the quantity of water pumped and fuel consumed has been larger than was hoped for the first year. To properly arrive at the saving that the Board have made, the increase of each year should be added to the decrease of the year's consumption.

By consulting the engineer's table I find that the average yearly increase for the past ten years has been in water 1,033,442,334 gallons, and the increase in the cost of fuel $2,862.00, although the increase in cost of fuel of 1888 over 1887 was $3,685.83. The decrease of water pumped in 1889 was 1,504,832,217 gallons, which added to the average increase makes a saving of 2,538,274,551 gallons. The decrease of cost of fuel was $5,155.49, which added to the average increase gives a saving of $8,017.49.

There has been expended for Examiners $4,041.25, and in

meters $10,921.20. This latter amount, however, is
pense for one year, properly speaking, as the life of a
ithout any expense for repairs, is on the average more
years; so that practically the most that can be claimed
xpense is one-tenth, or $1,092.12. I however contend
expense for meters should not be taken into considera-
ll, in estimating the saving, inasmuch as the gross
rom all places metered will be at least 25 per cent.
n was formerly realized from the same places under
sment plan. This of itself will more than provide for
nse attending the purchase and placing of meters.

terest on an investment is a legitimate expense, and
ve been an actual one with the Board, had it entered
roject of laying another 42-inch supply main and the
of another engine, as at first seemed absolutely neces-
very year then that this extension can be postponed is
in the annual interest on the cost thereof.

mate the actual saving made the past year, the inter-
he estimated expense should be considered, and it
as follows:

4 per cent. for 9 months	$18,000 00
ing in expense for fuel	8,017 97
saving in lubricators, repairs, etc	500 00
Total,	$26,517,97

t which is the following expense:

r examiners	$3,939 85
in office	240 00
irculars, etc,	131 00
Total,	$4,310 85

ng of $22,207.12.

ving that I have made has been based upon the oper-
the entire year, whereas, the measures to prevent
only inaugurated April 1st, and hardly under good
fore half the year was past. Should the estimates
m such time, the showing would be more favorable
d.

It is with considerable pleasure that I am able to report that the introduction of meters has met with but very little opposition, and, considering the fact that in almost all other cities it has been attended with denunciations and many litigations, the Board certainly have cause to congratulate themselves upon the manner in which their fellow-citizens have received and indorsed their action.

There are some prominent manufacturers who argue that the introduction of meters is an unnecessary restriction, and an injury to the business interests of the city, because (as is stated by them) it increases the rates upon factories, and will therefore have a tendency to prevent their establishment in the city in future.

The facts are, however, that a large majority of our manufacturers are paying less than under the assessment plan, and that, in the few cases where more is paid, it was because their uses of water were greatly misunderstood by the assessors. There were none, however, among those who protested against the introduction of meters who were able to give me any good and substantial reason why the Board of Water Commissioners should not know, or be able to ascertain, how much water was consumed, especially as the amount charged is based upon the quantity used.

The introduction of meters has brought to light many unjust discriminations that were innocently made under the assessment plan. The following is an example: Two manufacturing firms, engaged in the same business, and competing for the same trade were assessed respectively $600 and $440. The firm assessed $600 asked to be metered last June and the request was complied with, and they have paid an average of $38 monthly, or what would be $456 annually. The firm assessed $440, or $160 less than the other firm, was metered at my direction in October, and paid for the months of November and December $384, or what would be an annual rate of $2,304, or nearly six times more than the other firm that, under the assessment plan, paid $160 more than they did.

It certainly seems that any system of assessments that will

wever innocently, such unjust discriminations as the
ould be abandoned as soon as possible, and one adopt-
ould in each and every case ascertain the exact con-
; after which, I am confident, the Board of Water
oners can be trusted by their fellow-citizens to make
therefor as low as the welfare of the works will per-

lusion on this subject I desire to include in my report,
that appeared in the *Western Fireman and Journal*
Works, Jan. 8, 1890:

> WATER METERS.
>
> ittee of the Common Council of Rochester, N. Y., which was
> some time ago to investigate the alleged inadequateness of the
> ly of that city, has reported in favor of the general adoption
> of meterage, instead of the construction of an addition to the
> dy in operation. This is sound sense, and is in line with the
> gress of water supply. Time was when the only question of
> ly was of volume. The coal was heaped into the furnace, and
> were worked to their capacity and more, that open taps might
> , and water waste might be sustained. Now it is a question
> d every pound of coal must pump the most water possible, and
> the highest productive power there must be a minimum of
>
> er is a modern innovation, and it has made for itself a record
> -saver for the people. If the people pay a fixed rate per gal-
> the water that is pumped, the gross amount paid will, in most
> ess than if a general estimate is the basis of the rate, while
> ased gross revenue, the net profits of the company are often
> and a mutual benefit results from the substitution of business
> or guess work. The meter system is a good one, and the more
> it may be adopted the more satisfactory will be the meter ser-
> th company and patrons. Concerning the use and ownership
> Supt. Darling, of Pawtucket, R. I., said, in a paper read last
> re the American Water Works Association, at Louisville:
>
> > e it costs less to supply and maintain meters than it does to
> > ping engines and storage reservoirs. The cost of coal, while it
> > the expense account, has its bearing where water is legiti-
> > ed and paid for, but where it is wasted it has a further value,
> > s with it the cost of machinery, stations, pipe lines and new
> > supply, besides the wear and tear, the continuous expense of
> > and the pay of engineers and firemen. I would like to ask the
> > of superintendents as to the effect extreme cold weather has
> > ily consumption of water. I have about 2,000 services un-
> > th from one to two faucets. Now, my experience is, let it
> > ights and we are obliged to pump 500,000 gallons more per

day to supply the waste from these services alone, for the other ones are metered and we receive pay for the water. Please make a comparative estimate from your own situation. As a result of the meter system in Pawtucket, in 1879 our works cost over $600,000, and the revenue was $16,000 for that year. It was thought by many that we could never pay the interest on the debt, but in 1882 the revenue was $47,000, and the commissioners reported that they were able to pay all interest and maintenance accounts. Since 1879 we have increased the debt from year to year by building necessary dams, reservoirs and pumping stations, so that it now amounts to about $1,550,000, and we have paid all maintenance and interest accounts on the same, and passed into the sinking fund and construction account $44,000 beside. Our works are now fitted to do the necessary work for many years to come without any large expenditure of money, and an increase of revenue is sure to follow. You must also remember that our rates are as low as or lower than the majority of other water works, under similar situations. Our revenue for the past year was $95,000, using less than 4,000,000 gallons per day, and supplying a population of about 55,000, with a consumption of 65 per cent. for purposes other than family use.

PUMPING CAPACITY OF THE WORKS.

It may seem strange to your honorable body that I should indulge in any remarks under the above heading, but the supply and demand are so intimately associated, and the demand coming under my personal supervision, has forced my attention to some of the features of the means of supply.

Under the influence of the measures introduced for the prevention of waste, the consumption of water rapidly decreased, and especially during nights and Sundays. The maintaining the same head as usual at the pumping works, resulted in a very largely increased head throughout the city during the hours of cessation from business, the result of which was to cause sundry leaks and bursts, and to largely increase the consumption of water wherever running streams were still permitted, either through carelessness or defective plumbing.

I urged the Engineer continually to reduce the head at the times above specified, which he gradually complied with as far as he was able.

The pumping engine supplying the lower service has lately been run with one pump unshipped, and so slowly as often to require the use of a lever to prevent it from stopping. At the same time the waste gate is commonly partially opened to relieve the unnecessary pressure that even this greatly reduced force produced.

hairman of the Committee on Supply of Water, Com- r Pridgeon, had developed the fact by observation riment that a pressure of 17 lbs. at the office was indi- a sufficient pressure throughout the city, to answer d purposes and demands, and instructed me to charge neer to keep no less than such head at the office, and, le, no more.

therefore kept a record each hour, upon blanks pre- that purpose, of the pressure at the office, and had telephoned to the pumping works, but notwithstand- fforts of the Engineer, the pressure has been 6 to 8 ter nights and Sundays than during business hours. wing is a record of the ordinary daily pressure:

A. M.												P. M.											
1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Lbs. pressure.												Lbs. pressure.											
24	23	23	23	23	24	23	20	19	18	19	17	19	18	18	19	21	22	22	23	23	23	24	23

ie opinion of your Secretary that, had the Engineer to reduce the pumping power at the works in pro- the demand, the quantity of water pumped would still further considerably reduced.

evelops the fact that there is a minimum point as well mum, in our capacity to supply, and that if the Board ates the purchase of a new engine, it should be one iderably inferior capacity to those already in opera- that *one* engine of such reduced capacity would be he works require.

VALUATION OF THE WORKS.

t report, I stated that the Superintendent and myself ontemplation to make a correct inventory of the f the Board, so that the valuation of the works, arrived at by estimation, might be exactly known.

In accordance with such plan, we have carefully prepared and submit herewith an inventory of all the possessions of the Board, with their present valuations.

In placing values upon the real estate, we have called to our assistance W. S. Green, so many years in charge of the large interests of Wm. B. Wesson. Mr. Green is generally considered one of the best judges of real estate in the city, and the valuations placed upon that of the Board are those arrived at by himself. These valuations may be recapitulated as follows:

Office building and lot	$51,000 00	
Old pumping works, foot of Orleans street	41,250 00	
Reservoir grounds and buildings	62,800 00	
Grounds at new pumping works	200,000 00	
Buildings, docks, basins, etc	691,003 99	
Pipe laid and in use	2,295,294 47	
Meters placed and in use	13,115 01	
		$3,354,463 47

TOOLS AND MATERIALS.

In office building	$8,159 50	
In repair department	494 40	
In meter department	1,890 03	
At reservoir	4,362 97	
Inspection	150 00	
At new pumping works	21,855 53	
In iron pipe department	19,534 14	
		$56,446 57
Aggregate		$3,410,910 04

NVENTORY OF THE WORKS.

OFFICE.

lot	$51,000 00	
	600 00	
	2,500 00	
	133 00	
	150 00	
	25 00	
	1,396 50	
	60 00	
	25 00	
	15 00	
	110 00	
rs.	10 00	
	25 00	
	18 00	
	12 00	
	10 00	
rties	100 00	
Superintendent's office	35 00	
	15 00	
	10 00	
	15 00	
	35 00	
s	35 00	
table	50 00	
	75 00	
etc.	2,500 00	
	200 00	
		$59,159 50

REPAIR DEPARTMENT.

	$494 40	
		$494 00

METERS.

in use	$13,115 01	
in stock	1,646 35	
	147 45	
als in stock	96 23	
		$15,005 04

RESERVOIR.

Grounds, including basins and buildings....	$62,800 00	
Railroad siding...........................	637 97	
Seven horses.............................	800 00	
Four repair wagons.......................	350 00	
Two heavy trucks.........................	400 00	
Two light trucks.........................	150 00	
Storage platform.........................	450 00	
Five derricks............................	700 00	
Tools....................................	875 00	
		$67,162 97

INSPECTION DEPARTMENT.

Three buggies............................	$50 00	
One cart.................................	100 00	
		$150 00

PUMPING WORKS.

Three lots, cor. Atwater and Orleans streets, 150 feet front.........................	$41,250 00	
		$41,250 00

NEW PUMPING WORKS.

Grounds..................................	$200,000 00	
Inlet pipe...............................	49,677 04	
Dock, basin and canal....................	64,825 72	
Conduit wells............................	43,128 64	
Engine, boiler and coal houses...........	127,391 23	
Stand pipe and tower.....................	29,804 25	
Pump wells...............................	53,648 58	
Engines..................................	255,973 21	
Boilers..................................	38,014 49	
Engineer's house and barn................	6,723 64	
Drawbridge and foundation................	5,316 90	
Drinking fountain........................	175 00	
Underground improvements.................	16,325 29	
		$891,003 99

TOOLS AND MATERIALS.

Tools....................................	1,571 21	
Materials (rope, waste, etc.)............	438 01	
Materials (guages, valves, etc.).........	949 19	
Materials (iron, lead, etc.).............	277 59	
Furniture................................	233 01	
Wood and coal............................	17,944 52	
Horse....................................	75 00	
Vehicles.................................	130 00	
Boats....................................	35 00	
Hose for grounds.........................	202 00	
		$21,855 53

PIPE IN GROUND.

of 45 inch pipe	$1,699 50	
of 42 inch pipe	612,177 14	
of 30 inch pipe	200,556 00	
of 24 inch pipe	239,023 33	
of 20 inch pipe	1,751 80	
of 18 inch pipe	278 40	
of 16 inch pipe	4,345 60	
of 12 inch pipe	4,439 25	
of 10 inch pipe	129,893 22	
of 8 inch pipe	156,630 10	
of 6 inch pipe	476,471 45	
of 4 inch pipe	429,178 68	
of 3 inch pipe	38,191 00	
of 2 inch pipe	659 00	
		$2.295,294 47

IN STOCK.

	$12,193 29	
	341 07	
s	310 79	
leeves	629 08	
nch	1,291 67	
nches	872 65	
	131 80	
	172 40	
	115 58	
	135 21	
	296 37	
	33 96	
	68 19	
	1,986 07	
	27 80	
	450 00	
ipe	388 21	
	90 00	
		$19,534 14
		$3.410,910 04

Which is respectfully submitted,

L. N. CASE,
Secretary.

R

THE MECHANICAL ENGINEER.

1852 . . .
1853 . . .
1854 . . .
1855 . . .
1856 . . .
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1887 .
1888 .
1889 .

'CHANICAL ENGINEER.

DETROIT, January 1, 1890.

ners:

ınor to submit the Engineer's re-

the number of gallons of water he years named.

er	Cost of Fuel consumed.	Average daily delivered.
271	....	646,411
743	$ 2,129 37	931,594
126	2,271 34	1,030,866
364	3,325 81	1,487,143
805	4,017 44	1,896,231
523	3,993 20	1,909,837
207	3,655 20	1,967,373
587	3,194 15	2,142,774
451	4,196 21	2,383,580
423	4,414 07	2,452,409
329	3,150 95	2,725,878
043	4,670 86	2,837,803
256	7,647 62	2,839,078
887	7,372 89	2,875,383
922	9,349 16	3,277,583
230	10,121 82	3,905,576
125	11,379 23	4,507,248
325	11,247 92	4,511,809
068	12,713 78	5,112,493
605	14,681 05	6,301,782
578	17,736 86	7,601,892
948	20,233 30	8,762,723
635	20,431 71	9,013,350
260	21,393 98	11,527,272
470	19,832 89	11,107,499
790	17,433 72	11,543,123
330	10,943 82	11,906,146
110	11,219 51	14,053,696
310	12,276 60	15,172,036
968	16,556 63	17,926,377
742	13,156 16	17,261,440
188	16,495 99	20,217,334
140	19,877 07	23,253,044
580	21,341 48	27,317,341
254	20,387 24	28,976,907
308	35,882 83	36,079,166
370	39,568 66	39,397,716
453	34,413 31	35,274,888

The following tables show in detail the work done by each engine during each month of the year.

ENGINE No. 1.

MONTHS.	Time run. H.	Time run. M.	Revolutions.	Gallons.	Cost of Kindling.	Pounds of Coal.	Cost of Coal.	Pounds of Coke.	Cost of Coke.	Total Cost.	Duty.	No. gals. with 1 lb. coal.
January	648		306,893	475,070,364	$5 72	602,174	$1,345 85			$1,351 57	73,691,943	788
February	672		363,606	562,862,088	5 62	716,775	1,601 99			1,607 61	74,660,354	785
March	712	25	347,827	538,436,196	2 84	662,275	1,480 18			1,483 02	74,585,537	813
April												
May	528		259,553	401,788,053	3 38	47,946	107 15	432,018	$626 42	736 95	78,193,810	837
June	336		168,733	261,198,684	1 60	341,145	762 45			764 05	71,518,113	765
July	391		145,265	224,870,220	2 38	298,471	667 08			669 46	70,374,265	753
August	479	15	242,802	375,857,496	2 95	482,564	1,078 53			1,081 48	72 758,245	778
September	707	25	344,130	532,713,240	3 00	679,472	1,492 50			1,495 50	73,232,859	784
October												
November												
December	720		383,064	340,900,560	3 70	423,392	906 05			909 75	75,242,458	805
Total	5,194	05	2,561,873	3,713,696,901	$31 19	4,254,214	$9 441 78	432,018	$656 42	$10,099 39		

ENGINE No. 2.

January	360		193,604	281,700,696	$3 16	358,310	$800 82			$803 98	73,436,635	776
February												
March	576		309,866	488,857,728	2 30	641,947	1,434 75			1,437 05	72,402,608	761
April	720		408,857	828,721,028	4 69	224,936	502 73	175,729	$254 80	762 22	73,733,233	820
May	528		270,719	345,758,592	3 37	128,241	288 85	305,261	442 62	734 84	73,470,280	786
June	657	25	347,422	322,126 620	3 12	440,000	983 40			986 52	68 384,553	782
July	336		186,276	149,765,904	2 14	200,888	448 98			451 12	69,637,477	745
August												
September	716		352,176	566,299,008	3 00	690,830	1,517 75			1,520 75	76,570,006	819
October	707	45	376,616	302,799,264	4 38	416,269	880 81			895 19	64,912,834	727
November	675	25	327,191	287,672,808	2 18	365,428	782 01			784 19	73,532,793	787
December	613	45	327,838	527,163,504	3 17	652,060	1,395 40			1,398 57	75,853,626	808
Total	5,890	20	3,100,565	3,600,865,152	$31 51	4,119,909	$9,045 50	480,990	$697 42	$9,774 43		

Total	5,904		3,089,318	5,560,772,400	$36 34	6,058,005	$13,373 94	778,772	$1,129 21	$14,539 49	...	...
Aggregate	16,988	25	8,751,756	12,875,334,453	$99 04	14,432,128	$31,861 22	1,691,780	$2,453 05	$34,413 31	...	...

Fuel consumed	$34,413 31
Salaries Engineers, Firemen, Coal Passers and other labor	18,999 25
Telephone	24 00
Repairs and Material	6,248 98
Lights	342 67
Lubricators ($443 72 used in 1888)	897 13
Supplies, rags, boiler compound, polish, etc	473 90
Tools and repairs to same	141 32
Freight and street car tickets	19 92
Total	$61,560 48

Cost per million gallons, $4.78.

Number *one* and *two* Engines were run part of the year with only one pump attached.

congratulate the Board on their success in stopping the e of water. As will be seen by the tables the amount of er pumped is 2,004,832,217 gallons less than the amount ped in 1888, which is attended by a great saving of fuel. only that, but it will, I think, do away with the immedi- necessity of building another engine.

notice that the pressure gauge at the water office does not v one half the pressure that we have at the pumping ion. This, in my opinion, is owing to the smallness of main on Jefferson avenue. From Orleans street to Gris- l street this main is only ten inches in diameter, and was about 50 years ago, and I have no doubt but that the nections from it are four or five times its area. It is plain e seen that the area of this pipe is altogether too small. en we carry at the engine house pressure gauge on the e main down town 45 pounds pressure, and 48 pounds ssure on the Fremont street main, and yet, the pressure ge at the office varies from 16 to 19 pounds, and there ld not be more than one-fourth difference with the proper of pipes.

have suggested in past years the propriety of placing safety es on all the mains running north and south on a line with h street, so that in the event of an accident to the force n on Jefferson avenue the pressure in the upper part of the being greater than that in the lower part, would close e valves and prevent the flow of water from the upper to lower part of the city, as it did on the 29th of September The entire pipeage of the city on that occasion was ost completely emptied of water, which is a strong argu- t in support of the position I have always taken in this ter.

have to report that the engines and boilers are in good king order at the present time. All the tubes of the eight ers have been taken out, cleaned, pieced and replaced, and boilers are now doing as good duty as ever, some of them ng to be patched and new stay bolts put in.

here has been a new beam pin put into number three

iron coupling pieces replaced with wrought
ery reason to believe that the weak point
very materially strengthened.

pumps in number one engine have been
s ring riveted on the plunger for a bearing
gs. The same has also been done on the
acking rings accurately turned so that they
vater tight. Number one engine has also
ngs put into the high steam piston.

s are, I consider, in a high state of efficiency
ry fair duty.

he breaking of the check valve and part of
ber one engine, was no doubt caused by a
had to cut through the block stone masonry
en pipe, it took about six weeks to complete
e it proved a very expensive job, it was done
manner and is much stronger than ever.

ve been placed on the discharge mains from
This will, I trust, prevent any undue strain,
he force mains or check valves.

repairs to engines and boilers has been con-
he past year, the largest part of which has
s. But, when the length of time the boilers
s taken into account, I do not think the
onsidered excessive although the cost per
nsiderable higher.

Respectfully submitted,

JOHN E. EDWARDS,
Engineer.

RT OF THE SUPERINTENDENT.

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EPORT OF THE SUPERINTENDENT.

DETROIT, January 2, 1890.

'd of Water Commissioners:

MEN :—In accordance with the regulations of your body, I have the honor to present my annual report ɔ the general condition of the progress made in this ıt.

the past year extensions have been made in the dis- pipes and mains in over 325 different places, making $28\frac{4691}{5280}$ miles; $1\frac{1}{4}$ miles of which was either taken up or lowered, and $8\frac{3}{4}$ miles of wooden logs, and 4,585 ll size iron pipe were discontinued.

a careful measurement of our wooden log system, ꞅ a considerable shrinkage in the mileage as hereto- ɘd, this is owing to some incorrect measurement of find with the amount discontinued the past year, ɔw only a little over 15 miles in use, though this ·m our previously recorded mileage, it is neverthe- ratifying to know that we are nearing the end of tem.

r system is telling grandly in lessening the waste ꞅ may be seen by the engineer's records compared ar 1888 and the added consumers of the past year. ı has been a long-felt need from the fact that the ority of the consumers have had no conception of e wastage of water there has been in addition to a of the same.

needed alteration was made in the force mains of g works the past year, engines No. 2 and 3 prior to on having to discharge together in the same main, which interfered greatly with a free and economic working of the same, about 45 feet of the east 42 inch main was moved eastward some 20 feet and about 60 feet extra was added to meet this end.

PIPEAGE.

The amount of iron pipe laid and relaid, and iron and wood pipe discontinued during the past year in connection with the distribution, is as follows: Iron pipe laid and relaid $28\frac{4691}{5280}$ miles. There have been $8\frac{4326}{5280}$ miles of wooden logs and 4,585 feet of iron pipe discontinued, making the net increase of pipeage $18\frac{103}{5280}$ miles this amount added to the measured lines of pipe and logs connected with the Works would make the total pipeage of the city $343\frac{3067}{5280}$ miles, of which $328\frac{1209}{5280}$ miles is iron pipe and $15\frac{1859}{5280}$ miles are wooden logs, which in detail is as follows :

Iron pipe	45	inch diameter	103 feet
“	42	“	44,909 “
“	30	“	32,400 “
“	24	“	49,693 “
“	20	“	461 “
“	18	“	87 “
“	16	“	1,552 “
“	12	“	1,973 “
“	10	“	86,022 “
“	8	“	142,391 “
“	6	“	603,255 “
“	4	“	681,236 “
“	3	“	85,980 “
“	2	“	2,636 “
Total feet			1,733,049 feet

IRON PIPE LAID IN 1889.

Iron pipe	42	inch diameter	60 feet
“	10	“	3,993 “
“	8	“	1,675 “
“	6	“	69,132 “
“	4	“	66,089 “
“	3	“	2,309 “
“	2	“	2,636 “
Total feet			145,894 feet

e past year 410 stop gates have been set and re-set n with the distribution pipe and mains of the fols and sizes.

NAMES OF GATES.	DIAMETER IN INCHES.	REMARKS.
lower Bros.	42	Re-set.
alvin Brass and Iron Compound....	10	Set.
" " "	8	"
" " "	6	"
" " "	4	"
" " "	6	Blow-offs.
" " "	4	"
Murdock Valve Co. "	10	Set.
" " " "	8	"
" " " "	6	"
" " " "	4	"
lower Bros. old.	4	Blow-offs.
ittsburg old.	4	"
udlow old.	4	Re-set.

now connected with the water mains 1,818 fire d 419 cisterns; 247 hydrants and 67 cisterns were t year.

ble of service connections with iron pipe and s shown by the reports of the district inspectors.

ABLE OF SERVICE CONNECTIONS.

s	NO. IN 1ST. DISTRICT.	NO. IN 2D. DISTRICT.	NO. IN 3D. DISTRICT.	NO. IN 4TH. DISTRICT.	Total of Each Kind.
n	2		1		3
	33	3	10	1	47
	21	29	10	3	63
	18	23	6	4	51
	1,038	1,489	257	661	3,445
	2,066	3,719	3,016	3,355	12,156
.	478	348	207	250	1,283
.	6,742	8,317	1,236	4,382	20,677
.	10,398	13,928	4,743	8,656	37,725

ock being new timbered with heavy oak stringers ;ht iron tie rods, the bank was graded from two feet 'ace of water to main ground with an easy slope of e and one-half to one, the sloping ground being cov- ;h stone chips from lower piles to two feet above

ck—The dock dividing the settling basin from the ıld receive attention the coming season. It will entire new system of piles, sheet piling and string- ink it barely safe to allow it to pass over another am at work making such drawings and specifications › the prosecution of this work, which I hope to our honorable body before the season opens.

wing to the very low state of the water in the river › years it was found necessary to dredge out the r, to allow of the heavy draught coal vessels to unloading. An average of about three feet was

; this report it is only courteous to say that there rmonious co-operation with the officers of the other ur city.

ed with this report are the locations of pipes and nventory of pipe, special castings and tools on hand , 1889.

HENRY BRIDGE,
Superintendent.

PIPEAGE OF THE CITY OF DETROIT.

ALPHABETED BY STREETS, SHOWING THE KIND AND SIZE OF THE IRON AND WOOD PIPE NOW IN USE.

LOCATION.	KIND.	DIAM. INCHES.
A st., w. from Vinewood ave. 439 ft.	iron.	4
Abbott st., from Cass to Tenth sts	"	24
" alley s. of, from Cass st. to e. line of Lognon farm	"	4
" alley n. of, from First to Twelfth sts	"	4
Adair st., from 424 ft. s. of Wight st. to Jefferson ave	"	4
Adams ave., from John R. to Randolph st	"	6
" from Witherell to Hastings st	"	4
" alley s. of, from 240 feet e. of Clifford st. to Cass ave	"	4
" alley n. of, from Woodward to 100 ft. w. of Cass aves	"	4
Adelaide st., from Woodward ave. to St. Antoine st.	"	4
" from St. Antoine to Hastings sts	wood.	2¼
" from Hastings to Orleans sts	iron.	4
" e. from Orleans st. 36 ft	"	18
" from Orleans st. to Gratiot ave	"	10
Alexandrine ave., from Woodward to Cass aves	"	6
" " from Cass to Third aves	wood.	3
" " w. from Fourth ave	iron.	3
" " e. from Crawford st	"	4
" " from Sixth to Seventh sts	"	4
" " from Woodward ave. to Brush farm	"	4
" " w. from Beaubien st. 195 feet	"	4
" " from Beaubien to St. Antoine sts	"	3
" " from St. Antoine to Rivard sts	wood.	3
" " from Rivard st. to 325 ft. e. of Russell st	"	2¼
" " crossing St. Antoine st	iron.	4
" " crossing Hastings st	"	4
" " crossing Rivard st.	"	4
" " crossing Russell st	"	4
" " from 260 ft. w. of Orleans st. to alley w. of Dubois st.	"	4
" " from alley w. of, to Dubois st	"	3
" " crossing Dubois st	"	4
" " from Dubois to Chene st	"	3
" " crossing Chene st	"	4
" " from Chene st. to 63 ft. e. of	"	3
" " from 63 ft. e. of Chene st. to Grandy ave	wood.	3
" " crossing Grandy ave	iron.	3
" " from 287 ft. w. of Collins to 401 ft. e. of Moran st	"	4
Alfred st., from Woodward ave to Rivard st	"	4
" from Rivard to Russell sts	wood.	2¼
" from Russell to Orleans sts	iron.	3
" from Orleans to Dubois sts	"	4
Amherst st., w. from Junction ave, 314 ft	"	4
Annexation st., e. from Junction ave. 558 ft	"	4
Anthon st., w. from Junction ave. 400 ft	"	4
Antietam st., from 462 ft. w. of Russell st. to 22 ft. w. of McDougall ave.,	"	4

ATION.	KIND.	DIAM. INCHES.
econd ave., 43 ft	iron	4
cond ave. 165 ft	"	3
welfth st., 198 ft	"	4
os. Campau aves	wood.	2¼
mpau ave	iron.	4
pau ave. 275 ft	wood.	2¼
Jos. Campau ave. to alley w. of McDougall	iron.	3
McDougall to Elmwood aves	"	3
o Mt. Elliott aves	"	4
er st	"	6
ave. to alley e. of Trumbull ave	"	4
umbull to National aves	wood.	3
. to Twelfth st	iron.	4
alley e. of Wabash ave	wood.	2¼
ve., 148 ft	iron.	4
st	"	4
th st	"	4
to Eighteenth sts	"	3
h st	"	4
ave., 166 ft	"	3
Sullivan aves	"	4
ve., 214 ft	"	3
ve,, 250 ft	"	4
ve	"	4
to Twenty-third st.	"	4
to Twenty-fourth sts	wood.	2¼
ourth st	iron.	4
nth st. to Vinewood ave	"	4
ave	"	6
to Shelby sts	"	3
to Bates sts	"	6
st. to 215 ft. e. of St. Aubin ave	"	4
of St. Aubin to McDougall aves	"	6
m alley w. of Bates to Randolph sts	"	4
th st	"	4
h st., 230 ft	wood.	2¼
ve,, 313 ft	iron.	4
ave. to Fifteenth st	"	24
wford sts	"	3
d st	"	4
Clifford sts	"	4
m alley n. of Park st. to Cass ave	"	4
m 230 ft. n. of Clifford st. to Grand River ave.	"	4
Twenty-fourth sts	"	8
urth st. to Vinewood ave	"	4
od ave., 29 ft	"	6
Scotten aves	"	4
Eighth sts	"	4
on to Kercheval aves	"	6
k ave	"	10
dward ave. to Crawford st	"	4
ward ave. to Brush st	"	3
Farmer sts	"	6
venth sts	"	4
Sixth st. to alley w. of	wood.	2¼

LOCATION.	KIND.	DIAM. INCHES.
Beacon st., from Brush st. to 211 ft. e. of St. Antoine st	iron.	4
Beaubien st., from Atwater to Clinton sts	"	6
" from Clinton to Watson sts	"	4
" from Watson st. to Harper ave	"	10
" from Harper ave. to n. Boulevard	"	6
Beaufait ave., n. from Jefferson ave. 585 ft	"	6
" from 585 ft. n. of Jefferson to 282 ft. n. of St. Paul aves.	"	4
" from Mack ave. to 777 ft. n. of Sylvester st	"	6
Bellevue ave., from Jefferson ave. to 466 ft. n. of Waterloo st	"	6
" crossing Mack to Pulford aves	"	6
" from Sylvester to Superior sts	"	6
" crossing Gratiot ave	"	6
" n. from Gratiot ave. 2162 ft	"	4
Bellair st., from Riopelle st. to St. Aubin ave	wood.	2¼
" e. from St. Aubin ave. 300 ft	iron.	4
" w. from Dubois st. 100 feet	"	3
" crossing Dubois st., 60 ft	"	4
" from Dubois to Chene sts	"	3
" crossing Chene st., 68 feet	"	4
" from Chene st. to Grandy ave	"	3
" from Grandy to Jos. Campau aves	wood.	2¼
" e. from McDougall ave. 402 ft	iron.	4
Benton st., from Brush to Russell sts	"	4
Berlin st., from Gratiot to Jos. Campau aves	"	3
" crossing Jos. Campau ave	"	4
" from Jos. Campau to alley w. of McDougall aves	wood.	2¼
" from alley e. of McDougall to Elmwood aves	iron.	3
" crossing Elmwood ave	"	4
" from Ellery st. to Mt. Elliott ave	"	4
Boulevard East, w. side, from 6 in. main to n. line of Jefferson ave,	"	6
" " e. side, from 6 in. main in Jefferson ave. to Congress st.	"	6
" North, n. side, from w. line of Grand River ave. to 600 ft. e. of e. line	"	4
" " s. side, from e. line of Grand River to ave. to e. side of West Boulevard	"	4
" " s. side, from Woodward ave to Russell st	"	4
" West. e, side, from s. side of N. Boulevard south 161 ft	"	4
" " w. side, from Baker st. to Shady Lane	"	3
" " w. side. n. from Fort st. main 40 feet	"	4
" " e. side, from Shady Lane to 560 ft. s. of Porter st	"	4
" " e. side, n. from Fort st. main 44 ft	"	4
Bowen pl., e. from Cass ave., 356 ft	"	4
Bratshaw st., from Third to Fourth aves	wood.	2¼
Brady st., from Woodward ave to Beaubien st	iron.	6
" from Beaubien to Russell sts	"	4
Brainard st., from Cass to Third aves	"	4
" from Third ave. to alley w. of	wood.	2¼
" from Fourth ave. to Crawford st	iron.	3
" from Sixth to Seventh st	"	4
Brandon ave,, from Hubbard to Junction aves	"	4
Breckenridge st., from 148 ft. e. of Seventeenth to Eighteenth sts	"	4
Brewster st., from Brush to Russell sts	"	4
" from Riopelle to Orleans sts	"	4
" from Dequindre st. to Gratiot ave	"	4
Brevoort pl., e. from Nineteenth st. 284 ft	"	4
" crossing Twenty-second st	"	4

CATION.	KIND.	DIAM. INCHES.
enty-second st., 240 ft	wood.	2¼
to Grand River aves	iron.	30
h ave. to Eighth st	“	4
ncoln ave	“	4
elfth st	“	4
-first to Twenty-second sts	“	4
st. to Jefferson ave	“	6
ave. to Congress st	“	4
st. to Gratiot ave	“	8
ve. to Wilkins st	“	4
pl. to Watson st	“	24
to Benton st	“	6
st	“	4
na st	“	4
nore ave , 280 ft	“	3
of Baltimore to 251 ft. n. of Milwaukee aves	“	4
o Hamlin aves	“	4
fth st. 132 ft	wood.	2¼
d River to Vinewood aves	iron.	30
abash ave., 172 ft	“	4
eventeenth st., 169 ft	“	4
teenth st. to 387 ft. w. of Humboldt ave	“	4
e. of Sullivan to w. line of Maybury aves	“	4
ird to Twenty-fourth sts. w. line	“	4
ten ave. to Twenty-ninth st	“	4
nty-eight st, s. to Twenty-eight, n. 70 ft	“	6
n ave. to Julia st	“	6
nth st. to alley e. of Trumbull ave	wood.	2¼
w. of Trumbull to National aves	“	2¼
abash ave., 263 ft	iron.	4
aybury ave., 227 ft	“	4
enth to Twenty-fourth sts	“	24
ave., 432 ft	“	4
ping Works to Mack ave	“	42
ft n. of Jefferson ave. to 2,050 ft. n. of	“	6
from Woodward ave. to Randolph st	“	24
from Monroe ave. to Bates st	“	6
of, from Bates st. to alley w	“	4
of, from alley w. of Bates to Randolph sts	“	4
to Russell sts	“	4
pelle st., 159 ft	“	4
ndre st. to St. Aubin ave	wood.	2¼
Aubin ave	iron.	4
bin ave. to Dubois st	wood.	2¼
of Dubois to e. line of Chene sts	iron.	4
of Chene st. to 306 ft, e	wood.	2¼
e, of Chene st. to Grandy ave	iron.	3
st. to Fort st	“	6
ave., 448 ft	“	4
er st. to Driggs ave	“	8
ft. s. of to 250 ft. n. of Fort st	“	6
Dix ave	“	6
do ave. to s. line of M. C. R. R.	“	6
dward to Third aves	“	30
dward to Third aves	“	4
th ave. to Crawford st	“	4

LOCATION.	KIND.	DIAM. INCHES.
Canfield ave., from Sixth to Seventh sts	iron.	3
" from Twelfth st. to 48 ft. e. of Thirteenth st	"	3
" e. from Thirteenth st. 48 ft	"	4
" from Woodward ave. to Collins st	"	42
" from Woodward ave. to Collins st	"	6
" w. from Mt. Elliott ave. 767 ft	"	4
Canton ave., n. from Jefferson ave. 240 ft	"	6
" crossing Mack ave	"	6
Caroline st., w. from Twelfth st. 192 ft	"	3 & 4
Cass st., from Woodbridge st. to Jefferson ave	"	8
" from Jefferson ave to Joy st	"	10
Cass ave., from Joy st. to Alexandrine ave	"	8
" from Alexandrine to 519 ft. n. of Holden aves	"	6
Cass st., from alley n. of Howard st. to alley s. of Michigan ave	"	4
" from alley n. of Michigan ave. to Spencer st	"	4
Cass ave., crossing Canfield ave	"	8
" alley w. of, from alley n. of Adams ave. to 119 ft. s. of Gilman st	"	4
" alley w. of, s. from Gilman st. 119 ft	"	3
" alley w. of, from Ledyard to Bagg sts	wood.	2¼
Catherine st., from Gratiot ave to Rivard st	iron.	4
" from Rivard to Dequindre sts	"	4
" crossing Rivard st	"	6
" from Dequindre st. to St. Aubin ave	"	3
" from St. Aubin to Elmwood aves	"	4
Cavalry ave., from 183 ft. s, of Cadet to n. line of Dix aves	"	6
" from Dix to Toledo aves	"	4
Celeron st., w. from Junction ave. 277 ft	"	4
Celia st., from Twelfth to Thirteenth sts	"	4
" from Thirteenth st. to Wabash ave	"	3
Champlain st., from Randolph st. to alley e. of	"	4
" from St. Antoine to Orleans sts	"	4
" from Orleans st. to Elmwood ave	"	6
" from Elmwood ave. to 250 ft. w. of Lieb st	"	4
" w. from Lieb st. 250 ft	"	3
" from Lieb st. to Helen ave	"	4
" from East Boulevard to Field ave	"	4
" alley n. of, from Brush to St. Antoine st	"	4
Charles st., from Sixth to Seventh sts	"	4
Charlevoix st., from Chene st. to Jos. Campau ave	wood.	2¼
" crossing Jos. Campau ave	iron.	4
" from Jos. Campau ave. to alley w. of McDougall ave	"	3
" from alley e. of McDougall to Elmwood aves	"	4
Charlotte ave., from Woodward to alley e, of Third aves	"	4
" w. from Fourth ave. 131 ft	"	3
" e. from Fifth st. 180 ft	"	4
Chase st., from alley e. of Russell to 35 ft. w. of Riopelle sts	"	3
Chene st., from Atwater st. to Hancock ave	iron.	6
" from 141 ft. s. of Theodore st. to 130 ft. n. of Ferry ave	"	6
" from 100 ft. s. of Medbury to Harper ave	"	6
" from Congress st. to Canfield ave	"	30
" Second alley e. of, n. from Forest ave. "main," 36 ft	"	4
" Second alley e. of, n. from Forest ave., 260 ft	"	3
Cherry st., from Grand River to alley w. of Trumbull ave	"	4
" from alley w. of Trumbull to National ave	"	3
" from Harrison ave. to Twelfth st	wood.	2¼

CATION.	KIND.	DIAM. INCHES.
th st. "main," 36 ft	iron.	4
ll st. to Elmwood ave	"	4
eteenth st. 246 ft	"	4
Tenth st., n. of Church st., w. 170 ft	"	4
om Eighth to Tenth sts	"	4
Fort st	"	8
st n. of Fort st. to s. line of M. C. R. R	"	8
f M. C. R. R. to Michigan ave	"	6
grounds	"	6
n Car Works to Michigan ave	"	4
rawford st	"	4
rford st. to alley w. of Fourth ave	"	3
Aubin ave. 176 ft	"	4
t. w. of Dubois to Chene st	wood.	2¼
hene st. 377 ft	"	3
t. e. of, to 582 ft. e. of Chene st	"	2¼
os. Campau ave. 314 ft	iron.	4
os. Campau ave	"	4
s. Campau ave. 400 ft	wood.	3
e. of McDougall to Elmwood ave	iron.	4
mwood ave. 650 ft	"	3
t. to 762 ft. e. of Elmwood ave	"	4
. of Griswold st. to Washington ave., e. line	"	4
. to Sproat st	"	4
ot ave. to Rivard st	"	10
d to Orleans sts	"	16
ns st. to Elmwood ave	"	8
to Canfield ave	"	42
st. to Canfield ave	"	4
eld ave. 563 ft	"	3
of Canfield to 26 ft. n. of Hancock aves	"	4
ward to Cass aves	"	4
ward ave. to John R st	"	6
R to Beaubien sts	"	4
bien to Rivard sts	"	6
from Woodward to Cass aves	"	6
Fort st. 570 ft	"	3
st	"	4
rom Putnam ave. 168 ft	"	6
by ave. to 52 ft. s. of Stanley ave	"	6
Iolden ave. 214 ft	"	6
rson ave. to 20 ft. n. of Waterloo st	"	6
. s. of Berlin st. to Mack ave	"	6
atiot ave. 444 ft	"	6
rom Griswold to Third sts	"	4
e. from Tenth st. 250 ft	"	4
rom Sixth to Seventh sts	"	4
rom 80 ft. e. of Brush to St. Antoine sts.	"	4
rom alley w. of Woodward ave. to Shelby st.	"	4
rom Shelby to Cass sts	"	6
rom Cass to Fourth sts	"	4
rom Fourth to Seventh sts	"	8
rom Seventh to Eighth sts	"	4
rom alley e. of Woodward ave. 94 ft. e., in House	"	3
from alley w. of Brush to St. Antoine sts	"	4

LOCATION.	KIND.	DIAM. INCHES.
Congress st., from Randolph st. to St. Aubin ave	iron	24
" from St. Aubin to Meldrum aves	"	42
" from Bates to Brush sts	"	4
" from St. Antoine st. to Mt. Elliott ave	"	4
" w. from Helen ave. 171 ft	"	4
" from e. line of East Boulevard to Field ave	"	4
Connor Pl., n. from Warren ave. 313 ft	"	4
Crawford st., from Bagg st. to Lothrop ave.	"	6
" n. from Lothrop ave. 3,984 ft.	"	4
" crossing Brigham st	"	8
Crane ave., crossing Jefferson ave	"	4
" n. from Jefferson ave. 372 ft	wood	3
" crossing Mack ave	iron	6
Croghan st., from St. Antoine st. to Elmwood ave	"	4
" w. from Lieb st. 216 ft	"	4
" w. from Helen ave. 185 ft	"	4
Cross st., alley n. of, from John R to Randolph sts	"	4
Crystal st., from Trombly to Milwaukee aves	"	4
Custer ave., e. from Woodward ave. 250 ft	"	4
" e. from Brush st. 215 ft	"	4
" from Oakland ave. to Hastings st.	"	4
D st., w. from Vinewood ave. 300 ft.	"	4
Dalzelle st., crossing Twelfth st	"	4
" from Twelfth to Thirteenth sts	"	3
" from Foundry to Twenty-second st	wood	2¼
" from Twenty-third to Twenty-fourth sts	iron	4
Davenport st., from Woodward to Cass aves	"	4
Davis Pl., s. from Theodore st. 280 ft	wood	2¼
Dequindre st., from Woodbridge st. to Jefferson ave	iron	6
" from Jay to Waterloo sts	"	4
" s. from Adelaide st. 206 ft	"	4
" from Alfred to Pierce sts	"	4
" from Canfield to Willis aves	"	4
Dequindre st., alley e. of. s. from Ferry ave. 116 ft	wood	2¼
Division st., from Brush st. to St. Aubin ave	iron	4
Dix ave., from Twenty-fourth to Artillery ave	"	10
Dragoon ave., crossing River st	"	6
" from s. line of Fort st. to Army ave	"	6
" crossing Dix av	"	6
Driggs ave., from Junction to Campbell aves	"	4
Dry Dock st., from Swain ave. to Lady's Lane	"	4
Dubois st., from Franklin st. to Clinton ave	"	6
" from Maple to Hunt sts	wood	2¼
" from Hunt to Leland sts	iron	6
" from Leland st. to Canfield ave	"	3
" from Canfield to Warren aves	"	4
" from Farnsworth to 188 feet n. of Frederick sts	"	4
" from Perry to 110 feet n. of Palmer aves	"	4
" from Medbury to Harper aves	"	4
Duffield st., from Woodward to Cass aves	"	4
Dunn st., e. from Wesson ave. 160 feet	"	3
E st., w. from Vinewood ave. 416 ft	"	4
Edmund pl., from Woodward ave. to Brush st	"	24
Eighth st., from River st. to alley s. of Fort st	"	4
" from Fort st. to alley n. of	wood	2¼
" from Baker st. to Michigan ave	iron	3

OATION.	KIND.	DIAM. INCHES.
ave. to Orchard st	wood	2¼
iver ave. to Lysander st	iron	4
am st. 40 feet	"	6
t to 50 ft. n. of Linden sts	"	6
t. n. of Linden st. n. 370 feet	"	3
feet n. of Linden st. n. 98 feet	"	4
feet n. of Linden to Buchanan st	"	6
hanan to 369 ft. n. of Breckenridge sts	"	4
nd River to Kirby aves	"	6
cGraw ave. 1107 feet	"	6
f, n. from Porter st	wood	3
, s. from River st. 504 ft	iron	3
from River st. to Fort st	"	4
s from alley e. of Woodward ave. to 200 ft. w. sh st.	"	4
. w. of Brush to Hastings sts	"	4
from alley e. of Woodward av. to Witherell st.	"	3
Berlin sts	"	6
e. to Hancock ave	"	3
l ave. to Riopelle st	"	4
. to alley e. of Trumbull ave	wood	3
Trumbull to National aves	"	3
Thirteenth st. to alley e. of Wabash ave	"	2¼
erson ave to Croghan st	iron	4
ghan to Sherman sts	"	6
erloo to Hunt sts	"	4
t st. to Gratiot ave	"	6
ard ave. to Brush st	"	4
ave. 188 ft	"	4
t. to Gratiot ave	"	6
to 38 ft. n. of 30-inch main in Gratiot ave	"	8
odward ave. to Beaubien st	"	6
ubien to 108 ft. e. of Russell st	wood	4
ft. e. to 266 ft. e. of Russell st	"	2¼
ft. e. of Russell to Chene sts	iron	4
Grandy ave	"	4
Moran st. 628 ft	"	3
River st. 975 ft	"	4
Fort st. 480 ft	"	4
Dix ave	"	6
Dix ave. 309 ft	"	6
ard ave. to Russell st	"	4
ll st. 763 ft	"	8
. of Russell to Dequindre sts	"	4
ire st. to St. Aubin ave	wood	3
in to 109 ft. e. of Jos. Campau ave	iron	4
m alley w. of St. Aubin ave. w. 168 ft	wood	2¼
n to Kercheval aves	iron	6
of Mack to Hendrie aves	"	6
alley n. of Lafayette ave	"	4
st. to alley n. of	"	4
ave. to Noble st. and on both sides of Elton d parks	"	4
to 144 ft. s. of Piquette aves	"	4
st. to Grand River ave	"	6
rren ave. 348 ft	"	6

LOCATION.	KIND.	DIAM. INCHES.
Fifteenth st., from Bagg to Buchanan sts	iron	24
First st., from Front st. to Jefferson ave	“	6
“ from Jefferson ave. to alley n. of	“	8
“ from Woodbridge to Fort sts	“	4
“ from Fort st. to Grand River ave	“	6
Florence st., n. from Harper ave. 124 feet	“	3
“ from 124 ft. to 264 ft. n. of Harper ave	“	4
Forest ave., from Woodward to Cass aves	wood	2¼
“ crossing Cass av	iron	4
“ from Fourth to Seventh sts	“	4
“ from National ave. to Twelfth st	“	4
“ from 28 ft. w. of Twenth-seventh st. to Vinewood ave.	“	4
“ from Woodward ave. to 324 ft. w. of Rivard st	“	4
“ crossing Russell st	“	4
“ from Riopelle to 377 ft. e. of Chene sts	“	4
“ w. from Grandy av. 225 ft	wood	2¼
“ crossing Grandy ave	iron	4
“ from Collins to Moran sts	“	4
“ w. from Mt. Elliott ave. 717 ft	“	4
“ alley n. of, crossing Orleans st	“	4
“ alley n.of, from w. line of Orleans to alley e. of Riopelle sts.	“	3
Fort st., from Woodward ave. to Griswold st	“	4
“ from Seventh st. to Fourteenth ave	“	6
“ from Fourteenth ave. to Hoffman st	“	8
“ from Hoffman to Twenty-fourth sts.	“	6
“ from Twenty-fourth to Artillery ave	“	8
“ from St. Antoine st. to Mt. Elliott ave	“	4
Fort st. w. from Helen ave. 168 ft	iron	4
“ alley n. of w. from Brush st. 135 ft	wood	2¼
“ alley n. of from Brush to St. Antoine sts	iron	4
Foundry st. from Baker st.to Michigan ave	“	6
Fourth st, from Larned to alley s. of Fort sts	“	8
“ from alley s. of Fort st. to Grand River ave	“	6
Fourth ave.from Grand River ave. to Bagg st	“	4
“ from Bagg to Brigham sts	“	6
“ from Brigham st. to Holden ave.	“	4
“ alley e. of n. from Tuscola st. 87 ft	wood	2¼
Fourteenth ave. from Fort st. to Lafayette ave	iron	8
“ from Lafayette ave. to Bagg st	“	10
“ from Bagg st. to Grand River ave	“	8
“ from Grand River ave. to s. line of N. Boulevard.	“	6
“ w. side n. from Porter st. 500 ft	wood	2¼
Fox st. from Frank st. to Alexandrine ave	iron	3
“ crossing Alexandrine ave	“	4
Frank st. from Fourth ave. to 114 ft. w. of Sixth st	“	4
“ from 114 ft. w. ol Sixth st. to 75 ft. w. of Fox st	“	3
Franklin st. from Randolph to Beaubien sts	“	4
“ from Beaubien to Orleans sts	“	6
“ from Orleans to 25 ft. e. of Dequindre sts	“	4
“ from 25 ft. e. of Dequindre st. to McDougall ave	“	6
“ from Walker to Adair st	wood	2¼
“ w. from Lieb st. 310 ft	“	2¼
“ alley s. of, from McDougal! ave to Walker st	iron	4
“ alley n. of, from McDougall ave. to Walker st	“	4
Frederick st. crossing to 395 e. of John R st	“	4
“ w. from Hastings 306 ft	“	4

ATION.	KIND.	DIAM. INCHES.
. w. of Rivard to 178 feet e. of Russell sts	iron.	4
Aubin ave. to alley west of Dnbois st	"	4
st. to Jos. Campau ave	"	4
First to Second sts	"	4
Second to Third sts	"	4
ford st. to alley w. of Fourth ave	"	4
ward ave. to Brush farm	"	4
ien st to e. line of St. Antoine st	"	4
stings st. 359 ft	"	3
ll to 47 ft. e. of Chene st	"	4
st. to Grandy ave	wood.	3
andy ave	iron.	4
an ave. to G. T. R. R	"	6
a ave. 368 ft	"	4
rand River aves	"	4
oodward ave. to Cass st	"	8
ss to Third sts	"	6
ird st. to 400 ft. w. of Humboldt ave	"	8
ft. w. of Humboldt ave, to city limits	"	6
. from Eighth st. 110 ft	"	3
igham to Buchanan sts	"	30
ing with 30 main in line of Buchanan st, 22 ft	"	8
of, w. from Lincoln ave. 47 ft	"	4
of, from Trumbull ave. to alley w. of	"	6
ave. to Pierce st	"	4
st. to Harper ave	"	6
ave. 322 ft	"	4
. of Harper to 185 ft. n. of Trombly ave	"	6
h st	"	4
Thirteenth sts	"	3
nth st. to Wabash ave	"	3
ash ave	"	4
ard ave. to Brush st	"	10
t. to city limits	"	6
ard ave. to Raynor st	"	30
o Milwaukee aves	"	6
r to State sts	"	6
er to Atwater st	"	3
Iullett farm to Orleans st	"	4
to 117 ft. e. of St. Aubin ave	"	3
o Jos. Campau ave	"	4
u ave. to Walker st	"	6
st	"	4
to 300 ft. w. of St. Aubin ave	wood.	2¼
a ave. 300 ft	"	3
n ave. to 275 ft. e	iron.	4
t. 162 ft	"	3
st	"	4
t. 524 ft	wood.	2¼
. 100 ft	iron.	3
	"	4
Grandy ave	"	3
os. Campau aves	wood.	2¼
ard to Oakland aves	iron.	4
lo ave. to south line of L. S. R. R	"	6
et s. of Leavitt to 175 ft. n. of Ranspach sts	"	6

LOCATION.	KIND.	DIAM. INCHES.
Hancock ave. crossing Cass to 65 ft. e. of Hastings st	iron	4
“ from Rivard to Riopelle sts	“	4
“ from St. Aubin ave. to Dubois st	“	4
“ from 281 ft. w. of Chene st. to Grandy ave	“	4
“ e. from Mitchell ave. 235 ft	“	4
“ e. from Collins st. 92 ft	“	4
“ w. from Moran st, 305 ft	“	4
“ from alley w. of Ellery pl. to alley w. of Mt. Elliott ave.	“	4
“ from Fourth to Trumbull aves	“	4
“ from National ave. to 64 ft. w. of Thirteenth st	“	4
“ from Wabash to Fourteenth aves	“	8
“ crossing Fourteenth ave.	“	4
“ from 7 ft. w. of Twenty-seventh st. to Vinewood ave	“	4
“ from Lasalle to Scotten aves	“	4
Harper ave. from Woodward ave. to 175 ft. e. of Mansur st	“	4
“ crossing Russell st	“	4
“ crossing St. Aubin ave to Dubois st	“	4
“ e. from Chene st. 147 ft	iron.	4
“ w. from Grandy ave. 460 ft	wood.	2¼
“ from Grandy to Mitchell aves,	iron.	4
Harriet st., from Randolph to St. Antoine sts	“	4
Harrison ave., from Michigan to Grand River aves	“	4
“ from Merrick to 343 ft n. of Kirby aves	“	4
“ alley w of, from Linden st. s. to Linden st. n	“	4
Harvey ave., from Junction to 500 ft w. of Campbell ave	“	4
Hastings st., from Congress to Clinton sts	“	6
“ from 118 ft. s. of Congress to Fort sts	“	3
“ from Champlain to Croghan sts	“	3
“ from Clinton to Catherine sts	“	4
“ from Catherine to Watson sts	“	6
“ from Watson st. to Canfield ave	“	10
“ from Canfield to Forest aves	“	8
“ crossing Hancock ave	“	8
“ crossing Warren ave	“	8
“ crossing Theodore st	“	8
“ from Farnsworth st. to Ferry ave	“	6
“ from Harper to Piquette aves	“	6
“ from Piquette ave. to north line of N. Boulevard	“	4
“ from 20 ft. n. of N. Boulevard to Custer ave	“	4
“ alley w. of, n. from n. line of N. Boulevard, 553 ft	“	3
“ alley w. of, s. from Custer ave., 26 ft	“	4
Hazel st., from Harrison ave. to 156 ft. w. of Twelfth st	“	4
“ from 156 w. of Twelfth st. to 96 ft. e. of Thirteenth st	“	3
“ e. from Thirteenth st. 96 ft	“	4
Heck pl., crossing Forest ave	“	4
“ from Forest to Hancock aves	“	3
Heidelberg st., crossing Jos. Campau ave	“	4
“ e. from Jos. Campau ave., 270 ft	wood.	2¼
“ from 270 ft. to 445 ft. e. of Jos. Campau ave	iron.	3
“ from alley e. of McDougall to Elmwood aves	“	3
“ crossing Elmwood ave 39 ft	“	4
Helen ave., from Jefferson ave. to Croghan st.	“	6
“ from Gratiot ave. to s. line of N. Boulevard	“	6
Hendricks st., from St. Aubin ave. to Dubois st	“	3
“ from Dubois st. to alley w. of McDougall ave	“	4
“ from alley e. of McDougall to Elmwood aves	“	4

	KIND.	DIAM. INCHES.
ve. to 550 ft. e. of John R st	iron.	4
ve	“	4
to Clifford st	“	4
ves	“	6
lley e. 190 ft	“	4
ten aves	“	4
to Beaubien st	“	4
. Beaubien farm	“	3
to Russell st	“	4
le sts	“	3
to Fourth st	“	3
w. of Trumbull ave	“	4
bull to National aves	“	3
sts	“	8
Second aves	“	6
ird aves	wood.	3
rth aves	iron.	4
o Crawford st	wood.	3
to Commonwealth ave	iron.	4
er ave	“	4
er ave. 63 ft	“	4
h st. 221 ft	“	4
nois aves	“	4
akland ave	“	4
fth sts	“	4
dge to Twenty-fourth st	“	6
to Twenty-fifth sts	“	4
354 ft	“	4
35 ft. n. of Brandon ave	“	6
higan ave	“	4
e. to Myrtle st	“	6
272 ft	wood.	3
st 564 ft	iron.	4
er ave. 55 ft	“	4
venth st. 340	“	4
ve to Butternut st	“	4
nut st	“	6
st. to L. S. R. R	“	4
an st	“	6
t	“	4
w. of McDougall ave	wood.	2¼
Dougall ave	iron.	3
gall ave. 85 ft. e	wood.	3
of McDougall to Elmwood aves	iron.	4
ry st. to Mt. Elliott ave	“	4
ft, s	“	3
st	wood.	2¼
v. of Beaubien st	iron.	3
270 ft	wood.	2¼
	iron.	4
Antoine st	wood.	2¼
t	iron.	4
Hastings sts	wood.	2¼
	iron.	4
sell sts	wood.	2¼
	iron.	4

LOCATION.	KIND.	DIAM. INCHES.
Illinois st., from Russell st. e. 241 ft	wood.	2¼
" from 233 ft. w. of Riopelle to Dequindre sts	iron.	4
" from Dequindre st. to St. Aubin ave	wood.	2¼
" crossing St. Aubin ave	iron.	4
" from St. Aubin to Grandy aves	"	3
" crossing Dubois st	"	4
" crossing Chene st	"	4
" from Grandy to Jos. Campau aves	wood.	2¼
" from McDougall ave. e. 241 ft	iron.	3
" from 241 ft. e. of McDougall ave. e. 180 ft	"	4
Indiana st., from Beaubien to St. Antoine sts	wood.	3
" crossing St. Antoine st	iron.	4
" from St. Antoine to Hastings sts	wood.	2¼
" crossing Hastings st	iron.	4
" from Hastings to Rivard sts	wood.	2¼
" crossing Rivard st	iron.	4
" from Rivard to Russell sts	wood.	3
" crossing Russell st	iron.	4
Ingersoll st., e. from Wesson ave. 226 ft	"	4
Iron st., from Wight st. to Jefferson ave	"	6
Irving st., from Crawford to Seventh sts	"	4
Jay st., from Riopelle st. to 44 ft. w. of McDougall ave	"	4
Jefferson ave., from Griswold to Orleans st	"	10
" from Dequindre st. to M. C. Belt Line	"	6
" from M. C. Belt line to Crane ave	"	6
" from Meldrum ave. to Pumping Works	"	42
" from Griswold to First sts	"	8
" alley s. of, from alley w. of Woodward ave. to alley w. of Griswold	"	4
" alley s. of, from Shelby to Cass sts	"	4
" alley s. of, from alley w. of Bates to Randolph sts	"	4
" alley s. of, from Brush to Beaubien sts	"	3
" alley s. of, e. from Beaubien st. 189 ft	"	4
" alley n. of, from alley w. of Bates to St. Antoine sts	"	4
" alley n. of, from alley e. of Griswold to First sts	"	4
" alley n. of, from First to Third sts	"	8
Jerome ave., n. from Piquette ave, 473 ft	"	3
" from Milwaukee ave. to the N. Boulevard	"	4
Joe st., n. from Michigan ave. 887 ft	"	6
John R. st., from Miami to Madison aves	"	4
" from Madison to Adams ave	"	4
" from Adams ave. to Columbia st	"	6
" from Columbia st. to Edmund pl	"	8
" from Edmund pl. to Erskine st	"	6
" crossing Eliot st	"	6
" crossing Rowena st	"	6
" from Brady st. to Piquette ave	"	6
" n. from Baltimore ave. 250 ft	"	3
" s. from Milwaukee ave. 30 ft	"	6
Johnson st., e. from Nineteenth st. 240 ft	"	4
Jones st., from Cass to 160 ft. w. of Fifth sts	"	4
" e. from Sixth st. 240 ft	"	3
Jos. Campau ave., from Atwater to Clinton sts	"	6
" from Jay to Waterloo sts	"	6
" from Cleveland st. to Gratiot ave	"	6
" from s. line of Gratiot ave. to St. Joseph st	"	4

LOCATION.	KIND.	DIAM. INCHES.
rom St. Joseph to 302 ft. n. of Garfield ave	iron.	6
rom Theodore to 95 n. of Frederick sts	"	6
. from Ferry ave. 237 ft	"	6
rom 163 ft. s. of Hendrie to Medbury aves	"	6
. from Trombly ave. 812 ft	"	4
o alley e. of Third aves	"	4
a ave. to Fifth st	"	4
River st. to Driggs ave	"	6
Fort st. to 15 ft. s. of Wabash ave	"	6
s, side of Fort st. to n. of G. T. R. R	"	8
n Mt. Elliott to Beaufait aves	"	4
n Field to Sheridan ave	"	4
n Twenty-eighth st. 193 ft	"	4
oodward to w. line of Cass aves	"	4
Crawford st. 430 ft	"	3
Crawford st. 188 ft	"	4
venth st. to Trumbull ave	"	4
mmonwealth to National aves.	"	4
arrison ave. to 195 ft. w. of Twelfth st	"	4
xteenth to Eighteenth sts	"	4
Twenty-seventh st. 211 ft	"	4
John R. st	"	4
Russell st. 216 ft.	"	4
St. Aubin ave. 300 ft	"	4
Chene st. 440 ft	"	4
Grandy ave	"	4
Hellen ave. 238 ft	"	4
Fourth to Fifth sts	"	4
m Tenth st. 430 ft	"	3
m Twelfth st. 550 ft	wood.	3
. of, from alley e. of Fourth to alley e. of Twelfth	iron.	4
n. of, from Fifth to Eighth sts	"	4
n. of, from Eighth to Tenth sts	"	3
m Dry-dock st. 214 ft	"	4
m Griswold to Shelby sts	"	4
from Tenth st. 743 ft	"	4
m 743 ft. w. of Tenth st. to M. C. R. R. bridge	"	3
ssing Fourteenth ave	"	4
n Fourteenth ave. to Fifteenth st	"	3
m Fifteenth to alley w. of Sixteenth sts	"	4
m Twenty-first to Twenty-second sts	"	4
m Twenty-third to Twenty-fourth sts	"	4
rom Scotten ave. 238 ft	"	4
y s. of, from Griswold to Shelby sts	"	6
y s. of, from Wayne to First sts	"	6
y s. of, from First to Fourth sts	"	4
y s. of, from Fifth to Tenth sts	"	4
y n. of, from Shelby to First sts	"	4
y n. of, from First to Tenth sts	"	6
y n. of, e. from Fourteenth ave. 190 ft	"	3
River to Fort sts	"	4
Fort st. to M. C. R. R	"	6
Twenty-second st. 240 ft	wood.	2¼
g Twenty-second st	iron.	4
164 ft. e. to 562 ft. w. of Crawford st	"	4

LOCATION.	KIND.	DIAM. INCHES.
Langley ave., w. from Twenty-seventh st. 340 ft	iron	4
Lansing ave., n. from Fort st. 1968 feet	“	6
“ from Dix to Toledo aves	“	6
Larned st., from Bates to Brush sts	“	4
“ from St. Antoine to Dequindre sts	“	4
“ from Riopelle st. to St. Aubin ave	“	12
“ from St. Aubin to Elmwood aves	“	4
“ crossing Lieb st. 24 ft	“	4
“ from Lieb st. to Mt. Elliott ave	wood	2¼
“ w. from Helen ave. 156 ft	iron	4
“ from Woodward ave. to alley w	“	8
“ from Third to Fourth sts	“	8
“ from Fourth to Fifth sts	“	4
Lasalle ave., n. from Michigan ave. 505 ft	“	6
“ from G. T. R. R. to 400 ft. n. of Nall ave	“	6
“ from 359 ft. s. to 398 n. ft. of Hancock ave	“	6
Laurel st., from Grand River to Wabash aves	“	4
Leavitt ave., from Wesson to Livernois aves	“	4
Ledyard st., from Cass to Third aves	“	6
Lieb st., from Wight st. to Jefferson ave	“	6
“ from Jefferson ave. to Champlain st	“	4
“ from Champlain to Croghan st	“	3
Leland st., w. from Beaubien 206 ft	“	3
“ from Beaubien to Hastings sts	wood	2¼
“ crossing Hastings st	iron	4
“ from Hastings to Russell sts	wood	2¼
“ crossing Russell st	iron	4
“ e. from Russell st. 306 ft	wood	2¼
“ w. from Riopelle st. 212 ft	iron	4
“ from 28 ft. e. of Orleans to 21 ft. e. of Dequindre sts	“	4
“ from 21 ft. e. of Dequindre to 101 ft. w. of Dubois st	wood	2¼
“ from 101 ft. w. of Dubois to Chene sts	iron	3
“ crossing Chene st	“	4
“ e. from Chene 160 ft.	“	3
“ from 160 ft. e. of Chene st. to Grandy ave	wood	2¼
“ crossing Grandy ave	iron	3
“ from Grandy to Jos Campau aves	wood	2¼
“ crossing Jos. Campau ave	iron	4
“ from Jos. Campau to McDougall aves	wood	2¼
“ crossing McDougall ave	iron	4
“ from McDougall ave. to Collins st	“	3
“ from 240 ft. w. of Moran st. to Gratiot ave	“	4
Leroy pl., n. from Forest ave. 251 ft	“	3
Leverette st., from Seventh to Eighth sts	“	4
“ e. from Twelfth st. 307 ft	“	3 & 4
Lewis st., from Cass to Fourth sts	“	4
Lincoln ave., from Grand River ave. to alley n	“	4
“ crossing Brigham st. 36 ft	“	8
“ from Brigham st. to Holden ave	“	6
“ alley w. from alley n. of Grand River ave. to Brigham st.	“	4
“ alley w. of, s. from Brigham st. 16 ft	“	6
Linden st., w. from Harrison ave. 140 ft	“	4
“ e. from Twelfth st. 218 ft	wood	2¼
“ crossing Twelfth st	iron	4
“ from Twelfth to Thirteenth sts	wood	2¼
“ crossing Thirteenth st	iron	4

ATION.	KIND.	DIAM. INCHES.
h st. to Wabash ave	wood	2¼
sh ave	iron	4
o 45 ft. e. of Fourteenth aves	"	3
nth st.	"	4
. to Eighteenth sts	wood	2¼
oldt ave	iron	4
f Humboldt to Maybury aves	"	4
ve. to Twenty-fourth st	"	4
lfth to 26 ft. e. of Twenty-sixth st	"	4
ve. to M. C. R. R.	"	8
R. R. to n. line of city	"	10
er ave. to Fourth st	"	6
to alley e. of Trumbull ave	"	4
f Trumbull to 30 ft. e. of National ave	"	3
l ave. 30 ft	"	4
to Wabash aves	"	4
n ave. to Buchanan st	"	6
st. 912 ft	"	4
Mt. Elliott aves	"	4
Orleans st	"	4
ave. to Crawford st	"	3
h st	"	4
Seventh sts	"	3
n st. to Lincoln ave	"	4
l ave. to Twelfth st	"	4
Cadillac aves	"	42
450 ft. e. of Elmwood aves	"	4
Ellery st. to Mt. Elliott ave	"	4
liott ave	"	6
t to 312 ft. e. of Concord aves	"	4
. to Baldwin aves	"	6
Helen ave. w. 80 ft	"	6
oine st. to Elmwood ave	"	4
m Brush st. to alley w	"	3
m Brush to St. Antoine sts	"	4
m Brush to alley w. of	"	3
m Brush to St. Antoine st	"	4
from Wabash aves	wood	2¼
rom Fourteenth ave	"	2¼
ack ave	iron	10
ater to Clinton sts	"	6
iot to Canfield aves	"	4
lt to Berlin sts	"	4
ield to 34 ft. n. of Garfield aves	"	6
f, n. from Mullett st. 40 ft	"	4
, from Mullett to Antietam st	wood	2¼
, from Antietam to Jay sts	"	3
, from Cleveland to Hendricks sts	iron	3
, from Hendricks to Hunt sts	wood	2¼
, from Hunt to Charlevoix sts	iron	3
, from Charlevoix to Arndt sts	wood	3
, from Berlin to Heidelberg sts	"	2¼
from Mullett to Chestnut sts	iron	4
, from Waterloo to Preston sts	"	3
nth st. to 843 ft. w. of Eighteenth st	"	4
River ave. to Twenty-sixth st	"	4

LOCATION.	KIND.	DIAM. INCHES.
McKinstry ave., n. from River st. 875 feet	iron.	6
“ from Fort st. to n. line of Toledo ave	“	6
McMillan ave., crossing Livernois ave	“	4
Madison ave., from Witherell to John R. st., n. and s. sides	“	4
“ alley s. of, from John R. to Randolph sts	“	4
“ alley n. of, from John R. to Randolph sts	“	4
Magnolia st., from Harrison ave. to Thirteenth st	“	4
“ from Thirteenth st. to Wabash ave	“	3
“ from Eighteenth st. to Sullivan ave	“	3
“ from Sullivan to Maybury aves	wood.	2¼
“ crossing Humboldt ave	iron.	4
“ crossing Twenty-fourth st	“	4
“ w. from Twenty-third st. 190 ft	wood.	2¼
“ from Twenty-fourth st. to alley e. of	“	3
“ from Twenty-seventh st. to Vinewood ave	iron.	4
Maple st., from Gratiot ave. to Orleans st	“	8
“ from Orleans st. to St. Aubin ave	“	4
“ from St. Aubin to alley w. of McDougall aves	wood.	2¼
“ from alley e. of McDougall ave. e. 192 ft	“	3
Marcy st., w. from Fourth ave. 158 ft	iron.	3
“ from 158 ft. e. of Fourth ave. to Crawford st	“	4
Mark st., w. from Twelfth st. 180 ft	“	4
Martin pl., from Woodward ave. to John R. st	“	4
Maybury ave, from Mich. ave. to n. line of Ash st	“	6
“ from Ash to Buchanan sts	“	8
“ from Buchanan st. to L. S. R. R	wood.	2¼
Mechanic st., from Brush to Beaubien sts	iron.	4
Medbury ave., e. from Woodward ave. 1070 ft	“	4
“ crossing St. Aubin ave	“	4
“ w. from St. Aubin ave. 730 ft	“	3
“ w. from Dubois st. 146 ft	“	4
“ from 350 ft. w. of Grandy to Jos. Campau aves	“	4
Meldrum ave., from Jefferson ave. to Congress st	“	42
“ from Wight to 46 ft. n. of Fort st	“	6
“ from 46 ft. n. of Fort st. to 360 ft. n. of Kercheval ave.	“	4
“ from Mack to Gratiot aves	“	6
Merrick ave., crossing Cass ave	“	4
“ from Second to Third aves	“	4
“ e. from Crawford st. 21 ft	“	4
“ from 21 ft, e. to 387 ft. e. of Crawford st	“	3
“ e. from Lincoln ave. 176 ft	“	3
“ from Trumbull ave. to Twelfth st	“	4
“ w. from Twelfth st. 214 ft	“	3
“ from 214 ft. w. of Twelfth st. to Wabash ave	wood.	3
“ from Twenty-seventh st. to Vinewood ave	iron.	4
Miami ave., from Witherell to John R. st	“	4
“ alley w. of, from Gratiot ave. to alley s	“	6
“ alley w. of, from Gratiot ave. to alley s. of Witherell st	“	4
“ alley e. of, from Gratiot ave. to John R. st	“	4
Michigan ave., from Woodward ave. to Cass st	“	24
“ from Washington ave. to First st	“	10
“ from First to Twenty-fourth sts	“	8
“ from Twenty-fourth st. to Livernois ave	“	6
“ alley s. of, from Shelby to Cass sts	“	4
“ alley n. of. from alley e. of Griswold st. to alley e of Washington ave	“	4

ATION.	KIND.	DIAM. INCHES.
, from alley w. of Washington ave. to alley ass st	iron.	4
st. to n. line of Wabash R. R	"	6
. of Anthon st. to 157 ft. n. of McMillan st	"	6
eventh st	"	3
h st	"	4
ubien st. to Green ave	"	6
ubien st. to 414 ft. e. of Russell st	"	4
to 642 ft. s. of Fort st	"	6
. 642 ft	"	4
tiot ave. 265 ft	"	6
n. of Gratiot to Canfield aves	"	4
ld to 216 ft. n. ef Warren ave	"	6
. of Theodore to 175 ft. n. of Frederick sts	"	6
. of Hendrie to Harper ave	"	6
per ave. 324 ft	"	4
ly ave. to 47 ft. s. of N. Boulevard	"	4
illac square 51 ft	"	6
mer st. 375 ft	"	4
rom alley w. of Cadillac sq. to Randolph st	"	4
rom alley e. of Woodward ave. to alley e. of	"	4
from Farmer st. to alley w. of Randolph st	"	6
oodward ave. 412 ft	"	4
e. of Park st. to Cass ave	"	3
e. of Woodward ave. to Brush st	"	4
h to St. Antoine sts	"	3
ntoine to Hastings sts	"	6
ings to Russell sts	"	3
w. from Beaubien st. 240 ft	wood.	2¼
o Trombly aves	iron.	6
. to 132 ft. n. of Porter st	"	6
Dix ave. to 268 ft. n. of McMillan st	"	6
ft. s. of Wight to 1125 ft. s. of Waterloo sts	"	6
5 ft. s. of Waterloo to Preston sts	"	8
ston st. to Mack ave	"	10
ck to Gratiot aves	"	8
atiot ave. to city line	"	4
ave. to Chene st	"	30
oine st. to Elmwood ave	"	4
th to Thirteenth sts	"	4
iver to Hubbard aves	"	6
to Russell sts	"	4
igan to Grand River aves	"	6
s. of Lysander to 156 ft. n. of Putnam ave	"	6
ick to 345 ft. n. of Kirby aves	"	3 and 4
nth to Twentieth sts	"	6
dry st. in Griffins foundry	"	3
to Baker sts	"	4
r to Newark sts	"	6
ave. 150 ft	"	3
of Fourth ave. to Crawford st	"	4
eventh sts	"	4
on ave. 283 ft	"	4
ton to Hamlin aves	"	6
lfth st. 185 ft	"	3

LOCATION.	KIND.	DIAM. INCHES.
Orchard st. from First to e. side Elton Park	"	4
" from w. side Elton Park to Sixth st	"	4
" from Sixth st. to Trumbull ave	"	6
Orleans st. from Atwater st. to Jefferson ave	"	10
" from Jefferson ave. to Reservoir Grounds	"	8
" crossing Leland st. 57 ft	"	6
" from Alexandrine to Canfield aves	"	6
" n. from Garfield ave. 252 ft	"	4
" frnm 252 ft. n. of Garfield to 195 ft. n. of Forest aves	"	6
" from Trombly ave. to Lyman st	"	4
" from Congress st. to Reservoir	"	24
" from reservoir to Scott st	"	30
" s. from Garfield ave. 30 ft	"	30
Ottawa st. e. from Thirteenth st. 130 ft	"	3
Pallister ave. crossing Woodward ave	"	4
" from Woodward ave. to Russell st	wood.	3
" from Russell st. to 393 ft. e. of St. Aubin ave	iron.	6
Palmer ave. from Woodward ave. to w. line of Brush farm	"	4
" crossing Russell st	"	4
" crossing St. Aubin ave	"	4
" e. from Dubois st. 420 feet	"	4
" crossing Grandy ave	"	4
Park pl. from Michigan ave. to State st	"	4
Park st. from Woodward ave. to alley s. of Columbia st	"	6
" from Henry to Peterboro sts	"	4
Parsons st. from Woodward to Cass aves	"	4
Perry st. from Sixth to 319 ft. w. of Seventh st	"	4
" from alley e. of Trumbull ave. e. 300 [ft	wood.	2¼
" from alley w. of Trumbull to National aves	"	2¼
" alley s. of, from alley e. of Trumbull ave. e. 276 ft	iron.	3
" crossing Humboldt ave	"	3 and 4
Peterboro st. from Woodward to Cass aves	wood.	2¼
Pierce st. from Dequindre st. to St. Aubin ave	"	3
" crossing St. Aubin ave	iron.	4
" e. from St. Aubin ave 275 ft	"	4
" w. from Dubois st 172 ft	"	3
" crossing Dubois st	"	4
" from Dubois to Chene sts	wood.	2¼
" crossing Chene st	iron.	4
" from Chene st. to 180 ft. w. of Jos. Campau ave	wood.	3
" crossing Jos. Campau ave	iron.	3
Pine st. from Seventh st. to National ave	"	4
" from National ave. to Twelfth st	"	3
" crossing Twelfth st	"	4
Pitcher st. from Cass to alley e. of Third aves	"	4
" w. from Fourth ave. 150 ft	"	3
" from 150 ft. w. of Fourth ave. to Crawford st	"	4
" ftom Sixth to Seventh sts	"	4
Piquette ave. from Woodward ave. to Beaubien st	"	4
" trom Beaubien to Hastings sts	"	3
" from Hastings to Russell sts	"	4
" from Wabash to Fourteenth aves	"	4
" e. from Sullivan ave. 121 ft	iron.	4
Pleasant ave., n. from River st. 515 ft	"	4
Plum st., from Second st. to alley e. of Trumbull ave	"	4
" from Trumbull ave. to alley e. of	"	6

TION.	KIND.	DIAM. INCHES.
n ave. 400 ft	"	4
Livernois aves	"	4
Fourteenth aves	"	4
th st	"	4
h st	"	4
. to 209 ft. w. of Twenty-third st	"	4
st. 210 ft	"	3
th st. 160 ft	"	4
nth ave	"	4
th ave. 172 ft	"	3
th st. 130 ft	"	4
Eighteenth to Nineteenth sts	wood.	3
o Twenty-first sts	iron.	3
first st. 175 ft	wood.	2¼
econd st. 225 ft	iron.	3
ond to Twenty-third sts	"	4
rd to Twenty-fourth sts	wood.	2¼
rth st. to W. Boulevard, east side	iron.	4
d ave. 27 ft.	"	6
Scotten aves	"	3
ave. 271 ft	"	4
alley e. of Thirteenth st. 120 ft. w	"	3
287 ft. w. of Second aves	wood.	3
ave. 313 ft	"	2¼
Elmwood aves	"	3
to Mt. Elliott aves	iron.	4
n to Beaufait aves	"	4
dward ave. 60 ft	"	6
. of Woodward to Cass aves., w. line	"	4
ave. to 58 ft. w. of Seventh st	"	4
ull ave. to Twelfth st	"	4
of Atwater st. to Jefferson ave	"	4
to Congress sts	"	4
r st. to 24 in. main in Cadillac Square	"	8
ss st. to Adams ave	"	6
. from Atwater st	"	3
om alley s. of Fort to Champlain sts	"	4
om alley n. of Croghan st. to Gratiot ave.	"	4
tiot ave	"	10
Gratiot aves	"	4
ond to Livernois aves	"	4
st. 403 ft	"	3
st. 135 ft	"	4
to 438 ft. w. of Campbell aves	"	4
sin to 30 in. branch	"	24
. sides of Basin	"	24
ave. 156 ft	"	4
3 ft. w. of Lovett aves	"	4
st. to Jefferson ave	"	8
ave. to Larned st	"	12
roghan sts	"	3
tt st	"	8
Gratiot ave	"	6
st., 47 ft	"	4
High to Winder sts	wood.	2¼
o Adelaide sts	iron.	4
st. to 27 ft. n. of Hancock ave	"	6

LOCATION.	KIND.	DIAM. INCHES.
Riopelle st., alley e. of, s. from Canfield ave. 218 ft.	“	4
Rivard st., from Atwater st. to Jefferson ave.	“	8
“ from Larned to Congress sts.	“	4
“ from Jefferson to Clinton aves.	“	10
“ from Mullett st. to Gratiot ave.	“	10
“ from Gratiot ave. to Watson st.	“	4
“ from Eliot st. to Warren ave.	“	4
“ from Warren ave. to Farnsworth st.	wood.	3
“ from Farnsworth st. to 221 ft. n. of Ferry ave.	iron.	4
“ crossing Piquette ave.	“	4
“ from alley n. of N. Boulevard to Pallister ave.	“	4
River st., w. from Third st. 280 ft.	“	4
“ from Fifth to Sixth sts.	“	4
“ from Sixth st. to e. side M. C. R. R. tracks	iron.	8
“ crossing M. C. R. R. tracks, 270 ft.	“	6
“ from w. line of M. C. R. R. tracks to 525 ft. w. of Twenty-fourth st.	“	8
“ from Pleasant ave. to Campau st.	“	8
“ from Campau st. to main entrance Exposition grounds.	“	6
“ s. of main into Exposition grounds.	“	4
“ from main into Detroit & Lake Superior Copper Works.	“	4
Roby st., n. from Ferry ave. 325 ft.	“	4
Rose st., from Eighteenth to Twentieth sts.	“	4
Rowena st., from Woodward ave. to Riopelle st.	“	4
Rowland st., s. from State st. 187 ft.	“	4
“ n. from State st. 237 ft.	“	6
Russell st., from Congress to Croghan sts.	“	4
“ from Catharine to Watson sts.	“	4
“ from Watson st. to Garfield ave.	“	6
“ from Garfield to s. of Hendrie aves.	“	10
“ from s. of Hendrie to s. of Piquette aves.	“	8
“ from s. of Piquette to Pallister aves.	“	6
“ alley e. of, from Chase to Fort sts.	wood.	2¼
Savoy st., from Twenty-first to Twenty-second sts.	iron.	4
“ from Twenty-third to Twenty-fourth sts.	“	4
Schulte ave., from alley n. of N. Boulevard to Pallister ave.	“	4
Scott st., from Orleans st. to Chene st.	“	30
“ from Riopelle st. to St. Aubin ave.	“	4
“ from St. Aubin ave. to Dubois st.	“	3
“ crossing Dubois st.	“	4
“ e. from Dubois st. 190 ft.	wood.	3
“ from 435 ft. w. of to 499 ft. e. of Chene st.	iron.	3
“ crossing Chene st.	“	4
“ from 75 ft. w. of Grandy to Jos. Campau aves.	“	4
Scotten ave., from Fort st. to Dix ave.	iron.	6
“ from Dix ave to Buchanan st.	“	8
“ from Buchanan st. to McGraw ave.	“	6
Second st., from Front st. to alley n. of Jefferson ave.	“	6
“ from Michigan ave. to Plum st.	“	4
“ from High to 166 ft. n. of Henry st.	“	4
Second ave., from Bagg st. to 30 ft. n. of Prentiss ave.	“	6
“ crossing Canfield ave.	“	8
“ s. from Holden ave. 1,000 ft.	wood.	3
“ from Holden to 205 ft. n. of Milwaukee ave.	iron.	6
“ alley e. of, from Prentiss ave to alley s. of.	wood.	2¼
Selden ave., from Woodward to Third aves.	iron.	4

CATION.	KIND.	DIAM. INCHES.
1 ave to Crawford st..............	iron.	3
o Seventh sts..................................	wood.	2¼
enth st.........	iron.	4
t. to alley n. of Lafayette ave.................	"	8
. of Lafayette ave. to Bagg st..................	"	10
t. to Grand River ave.........................	"	8
River ave. to Brigham st........	"	6
gham st.................	"	8
m to 150 ft. n. of Lysander st........	wood.	2¼
n. of Lysander st. to Warren ave.............	iron.	6
s. of Kirby to Hudson aves...................	"	6
1. to 339 ft. n. of Stanley ave..................	"	6
from alley n. of Pine to Spruce sts............	"	3
rt st. to 28 ft. s. of Poplar st.................	iron.	6
ft. s. of Poplar to s. line of Buchanan st......	"	4
line of Buchanan st. to 20 ft. s. of Hancock	"	6
Kirby ave. 182 ft............	"	6
. Boulevard.......	"	4
newood ave.................	"	6
to Woodbridge sts..............	"	3
idge st. to Jefferson ave........	"	4
ridge st. to Jefferson ave......................	"	8
n to Michigan ave...............	"	10
tte to alley s. of Michigan ave............. ...	"	4
erson to Kercheval aves......................	"	6
ngs st. to Elmwood ave........................	"	4
rd ave. to Clifford st.........................	"	4
to alley n....................................	"	4
f Labrosse st. to Bagg st......................	"	4
t. 88 ft..	"	8
f Bagg st. to 473 ft. n. of Grand River ave....	"	4
of Grand River ave. to Brigham st............	"	6
am st......	"	6 & 8
of Brigham to Lysander sts..................	"	4
yette ave. to Myrtle st	"	6
tle to Buchanan sts...........................	"	8
anan st. to Grand River ave..	"	10
d River to McGraw aves......................	"	6
f, from Lafayette ave to Howard st...........	"	3
ard to Oakland ave...........	"	4
iver ave. to Noble st..........................	"	4
o Second sts....	"	4
rd to Cass aves..................	"	4
Seventh sts........................	"	4
. of Trumbull to National ave.................	wood.	2¼
om alley w. of Seventh st. to alley e. of Trum-	iron.	3
ft. e. of Dequindre st. to 260 ft. w. of St. Au- re....	"	4
St. Aubin ave 260 ft..........................	"	3
water to Congress st...........	"	8
gress st. to Gratiot ave........................	"	6
tiot ave. to Elizabeth st...	"	4
abeth to Aldelaide sts...	"	6
lelaide to Watson sts.......	"	8

LOCATION.	KIND.	DIAM. INCHES
St. Antoine st., from Watson to Farnsworth sts	iron.	6
" n. from Piquette ave. 445 ft	"	6
" n. from Milwaukee ave. 378 ft	"	6
St. Aubin ave., from Atwater st. to Harper ave	"	6
" crossing Trombly ave	"	6
" from Larned to Congress sts	"	12
" alley w. of, s. from Ferry ave. 266 ft	wood.	2¼
St. Clair pl., e. from Nineteenth st. 284 ft	iron.	4
St. Joseph st., from Russell to Riopelle sts	"	3
" crossing Riopelle st	"	4
" from Riopelle st. to 310 ft. e. of St. Aubin ave	"	4
" from 310 ft. e. of St. Aubin ave. to 202 ft. e. of Chene st.	"	3
" from 202 ft. e. of Chene st. to Grandy ave	"	4
St. Joseph st., crossing McDougall ave	iron.	4
" e. from McDougall ave. 438 ft	"	3 & 4
St. Paul ave., from Townsend to Baldwin aves	"	4
Stanley ave., from Seventh st. to Trumbull ave	"	4
Standish st., from Foundry to Twenty-first sts	wood.	3
Stark ave., from Welch to Livernois ave	iron.	4
State st., from Woodward to Washington aves	"	30
" 24 ft. w. of Branch in Washington ave	"	24
" from Woodward to Washington aves	"	10
Stimson pl., from Woodward to Cass aves	"	4
Sullivan ave., from Michigan ave to Magnolia st	wood.	3
" n. from Magnolia st. 190 ft	iron.	3
" crossing Butternut st	"	6
" from 289 ft. s. to 270 ft. n. of Linden st	"	6
" s. from Buchanan st. 288 ft	"	6
" from Piquette to 250 ft. n. of Wreford aves	"	6
Summit ave., from River st. to Wabash R. R	"	6
Superior st., w. from Beaubien st. 220 ft	"	4
" from Beaubien to Hastings sts	wood.	2¼
" e. from Hastings st. 359 ft	"	3
" crossing Hastings st	iron.	4
" crossing St. Antoine st	"	4
" crossing Russell st	"	4
" crossing Chene st	"	4
" crossing Grandy ave	"	4
" w. from Rivard st. 437 ft	"	3
" from Rivard to Russell sts	wood.	2¼
" from Riopelle to Dequindre sts	iron.	4
" from Dequindre st. to St. Aubin ave	wood.	2¼
" from St. Aubin ave. to 343 ft. e. of Chene st	iron.	3
" from 197 ft. w. of Grandy to Mitchell aves	wood.	3
" from McDougall ave. to 239 ft. e. of Collins st	iron.	4
" from Moran st. to Gratiot ave	"	4
Swain ave., from 40 ft. s. of Wabash R. R. to Fort st	"	6
Sycamore st., w. from Grand River ave. 123 ft	"	6
" from alley w. of Trumbull to National aves	"	4
" from Harrison to Wabash aves	"	4
Sylvester st., w. from Mt. Elliott ave. 388 ft	"	4
" from Beaufait to Bellevue aves	"	4
Tenth st., from River to Baker sts	"	8
" from Baker st. to Michigan ave	"	6
Theodore st., e. from John R. st. 402 ft	"	4
" from 226 ft. w. of Beaubien to e. line Rivard st	"	4

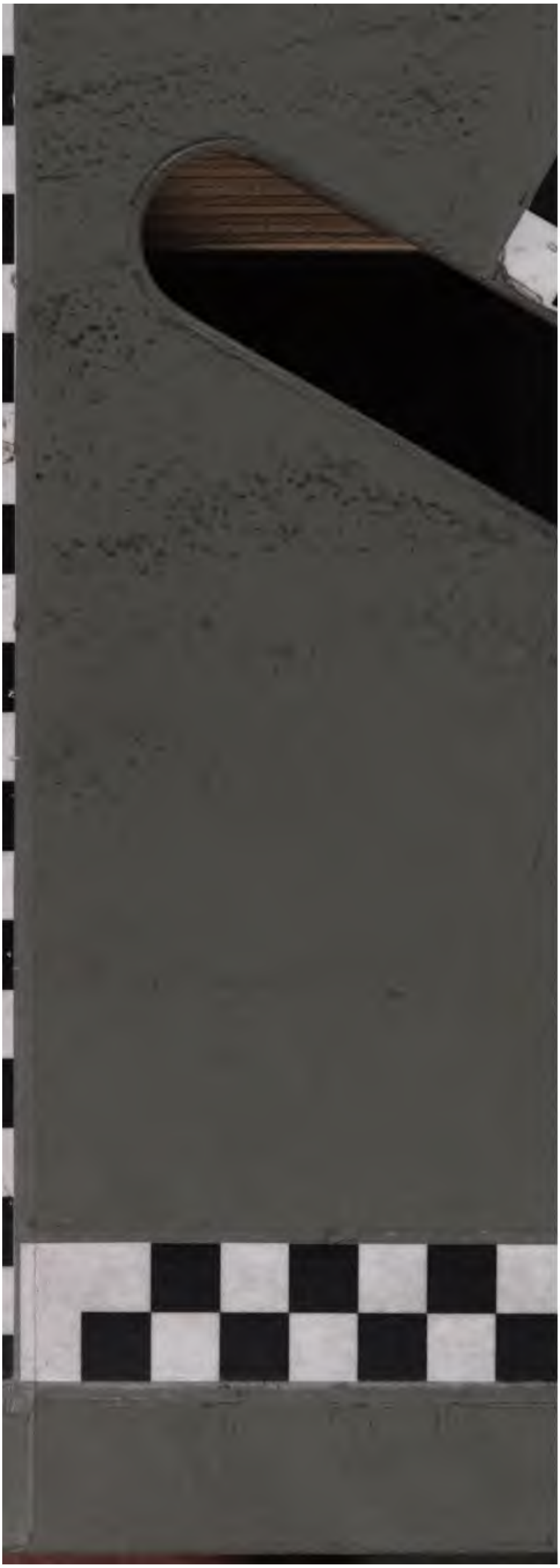
CATION.	KIND.	DIAM. INCHES.
of Riopelle to 106 ft, e	iron.	4
sell st. 450 ft	“	4
Aubin ave. 268 ft	“	4
w. of Chene st. to Grandy ave	“	4
alley n. of River st	“	4
. to alley s. of	“	8
. to alley n. of	“	6
ave. to Grand River ave	“	4
Porter st. to Michigan ave	“	3
iver ave. to Bagg st	“	8
st. to Canfield ave	“	30
am st. 60 ft	“	8
to Holden ave	“	6
m Henry to Brainard sts	iron.	4
r to 112 ft. n. of Elm sts	“	6
yrtle st	“	6
nolia st. to Grand River ave	“	6
and River ave. 499 ft	“	4
, s. from Porter st. 121 ft	“	4
igan ave. to Buchanan st	“	6
ichigan ave. to 15 ft. s. of Buchanan st	“	4
higan ave. to 39 ft. n. of Buchanan st	“	6
gan ave. to Breckenridge st	“	6
. of Scotten to McKinstry ave	“	4
stry to Livernois aves	“	6
al st. to St. Aubin ave	“	4
dy ave. to Moran st	“	4
erson ave. to 9 ft. s. of Kercheval ave	“	6
ack ave. 208 ft	“	6
t. n. of Mack to s. line Gratiot ave	“	4
igan ave. to Plum st	“	6
d River ave. to alley n. of	“	6
ham st. to Forest ave	“	8
st ave. to 56 ft. n. of Kirby	“	6
t. s. of Stanley ave. to 293 ft. n. of G. T. Ry	“	6
lden ave. 360 ft	“	6
, from Plum to Sycamore sts	“	6
f, from Cherry to Pine sts	“	3
, from Pine to Myrtle sts	“	4
f, from alley n. of Grand River ave. to Brig-	“	6
h ave. 130 ft	wood.	2¼
om Crawford st. 360 ft	“	2¼
from Crawford st. 394 ft	“	2¼
of River st. to Lafayette ave	iron.	4
o Baker sts	“	4
Brigham sts	“	6
st. to N. Boulevard	“	8
t. to Michigan ave	“	6
. from Rose st. 192 ft	“	3
t to Baker sts	“	4
er to Standish sts	“	4
ort to Baker sts	“	6
aker to Dalzelle sts	wood.	2¼
rt to 330 ft. n. of Porter sts	iron.	4
ft. n. of Porter to 419 ft. n. of Dalzelle sts	“	3

LOCATION	KIND.	DIAM. INCHES.
Twenty-third st. crossing Baker st	iron.	4
" n. from M. C. R. R. 259 ft	"	3
" from 259 ft. n. of M. C. R, R. to Michigan ave	"	6
" from Michigan ave. to Ash st	wood.	2¼
" from Ash st. to 286 ft. s. of Magnolia st	iron.	3
" s. from Magnolia st. 286 ft	wood.	2¼
" from Magnolia to 35 ft. n. of Linden sts	iron.	3
" from 35 ft. n. of Linden st. to L. S. R. R	"	4
" from Kirby to McGraw aves	"	4
" crossing Butternut st	"	6
" crossing Myrtle st	"	6
" crossing Buchanan st	"	6
Twenty-fourth st. from River to Fort sts	"	4
" from Fort to Baker sts	"	6
" from Baker st. to 20 ft. n. of Michigan ave	"	8
" from 20 ft. n. of, to 54 ft. n. of Michigan ave	"	12
" from 54 ft. n. of, to 96 ft. n, of Michigan ave	"	16
" from 96 ft. n. of, to 181 ft. n. of Michigan ave	"	18
" from 181 ft. n. of, to 236 ft. n. of Michigan ave	"	20
" from 236 ft. n. of Michigan ave. to Butternut st	"	24
" from Butternut to Buchanan sts	"	10
" n. from Buchanan st. 359 ft	"	4
" from 359 ft. n. to 887 ft. n. of Buchanan st	"	8
" from 50 ft. s. of, to 240 ft n. of Hudson ave	"	8
" from 240 ft. n. of Hudson to McGraw aves	"	4
Twenty-fifth st. from Howard to Baker sts	"	4
" n. from Dix ave. 1110 ft	"	6
" s. from Michigan ave. 730 ft	wood.	3
" from Michigan ave. to Linden st	iron.	6
" n. from Linden st. 192 ft	"	3
" from 595 ft. s. of to 129 ft. n. of Buchanan st	iron.	6
Twenty-sixth st., from 866 ft. s. of Michigan ave. to Lake Shore R. R.	"	6
" s. from Buchanan st. 804 ft	"	6
" from Hudson to McGraw aves	"	6
Twenty-seventh st., n. from Dix ave. 990 ft	"	6
" from Michigan ave. to Buchanan st	"	6
" from Merrick to Hudson aves	"	6
Twenty-eighth st., from Michigan ave. to 22 ft. n. of Kinsman st	"	6
Twenty-ninth st., from 565 ft. s. of to 579 ft. n. of Michigan ave	"	6
" from Jackson to Buchanan sts	"	6
Uthes ave., from Clark to McKinstry aves	"	4
Union st., from Fourth ave to Fifth st	"	8
Van Dyke ave., crossing Mack ave	"	6
Vine st., w. from Fourth ave. 158 ft	"	3
" e. from Fifth st. 188 ft	wood.	2¼
Vinewood ave., from Fort to Buchanan sts	iron.	24
" from Fort st. to 480 ft. n. of Toledo ave	"	6
" from F to Visgar sts	"	6
" from Visgar to Nall sts	"	3
" from Nall to Buchanan sts	"	6
" from Buchanan st. to Merrick ave	"	10
Visgar st., from Vinewood to LaSalle aves	"	6
Volunteer ave., w. from Junction ave. 315 ft	"	4
Wabash ave., from n. line of M. C. R. R. to Ottawa st	"	6
" from Ottawa to Lysander sts	"	4
" from Lysander st. to Lake Shore R. R	wood.	2¼

e Lake Shore R. R. to 186 ft. n. of Piquette ave	iron.	6
aolia to Hazel sts.	wood.	2¼
, from 135 ft. s. of Butternut to Myrtle st	"	2¼
, crossing Myrtle st	iron.	4
r st. to Jefferson ave	"	4
e of Cass ave. to 105 ft. e. of Riopelle st	"	4
ubin ave. to 211 ft. e. of Dubois st	"	4
randy ave	"	4
nd to Third aves	"	4
th ave. to Crawford st	wood.	2¼
ford to 106 ft. w. of Seventh sts	iron.	4
nal ave. to 194 ft. w. of Twelfth st	"	4
teenth ave. to Sixteenth st	"	
Michigan ave. to State st	"	30
Michigan to Grand River aves	"	10
w. of, from alley n. of Michigan ave. to alley Park st	"	4
. of, from alley n. of Michigan ave to alley s. ark st	"	4
lot to Jos. Campau aves	"	4
e. of McDougall to Elmwood aves	"	4
mwood ave, 562 feet	"	3
et e. of Elmwood ave. to w. line of Burlage pl.	"	4
lliott to 57 ft. e. of Beaufait aves	"	4
st. to Reservoir	"	24
ard ave. to Brush st	"	4
dre st. to St. Aubin ave	wood.	2¼
Aubin ave	iron.	4
in ave. to Dubois st	wood.	2¼
bois st	iron.	4
to Chene sts	wood.	2¼
ene st	iron.	4
dbridge st. 173 ft	"	4
lbridge st. to Michigan ave	"	6
eteenth st. 276 ft	"	4
enty-second st. 240 ft	wood.	2¼
r st. to s. line of M. C. R. R	iron.	6
s. to 225 ft. n. of Stark ave	"	6
s. of Michigan ave. to the city limits	"	6
lo ave. to L. S. R. R	"	6
R. R. to Leavitt ave	"	6
& N. R. R. to 190 ft. n. of Herbert st	"	6
Lieb sts	"	4
. to 110 ft. e. of Meldrum ave	"	6
from McDougall ave. 230 ft	"	4
to Russell sts	"	4
w. of Riopelle to Dequindre sts	"	4
uindre st. 540 ft	wood.	2¼
to 172 ft. w. of St. Aubin ave	iron.	4
in ave. to Dubois st	wood.	3
ois st	iron.	4
ois st. 225 ft	wood.	3
ne st. 375 ft	"	2¼
higan ave. to 24 ft. n. of Buchanan st	iron.	6
ard ave to Beaubien st	"	4
en to St. Antoine sts	"	3

Willis ave.,	e. from St. Antoine st. 296 ft	wood.	2¼
"	w. from Hastings st. 350 ft	"	3
"	e. from Hastings st. 356 ft	iron.	4
"	w. from Rivard st. 332 ft	"	3
"	e. from Rivard st. 320 ft	wood.	3
"	w. from Russell st. 36 ft	iron.	3
"	from w. line of Russell to Dequindre sts	"	4
"	from Dequindre st. to St. Aubin ave	wood.	2¼
"	crossing St. Aubin ave	iron.	4
"	from St. Aubin ave. to 80 ft. e. of Dubois st	wood.	3
"	w. from Chene st. 537 ft	iron.	3
"	crossing Chene st	"	4
"	from Chene st. to Grandy ave	"	3
"	from Jos. Campau to Mitchell aves	wood.	2¼
"	crossing Mitchell ave	iron.	4
"	from Mitchell to McDougall aves	wood.	2¼
"	e. from w. line of Mitchell ave. 291 ft	iron.	4
"	e. from Collins st. 146 ft	"	4
"	from Woodward to Third aves	"	6
"	from Fourth ave. to Crawford st	"	4
"	from Sixth to Eighth sts	wood.	2¼
"	e. from Twelfth st. 215 ft	"	3
"	crossing Twelfth st	iron.	4
Winder st.,	from Woodward ave. to Orleans st	"	4
Wing pl.,	e. from Nineteenth st. 220 ft	wood.	2¼
Winter st.,	e. from Dequindre st. 421 ft	iron.	4
Witherell st.,	from Woodward to Miami aves	"	6
"	from Miami to Adams aves	"	4
"	from Adams ave. to alley n. of	"	3
Woodbridge st.,	from Randolph to Brush st	"	4
"	alley s. of, from Bates to Randolph sts	"	4
"	alley s. of, from Brush st. to A. Beaubien farm	"	3
"	from L. Beaubien farm to St. Antoine st	"	3
"	from St. Antoine to Rivard sts	"	4
"	from Rivard to Russell sts	"	8
"	from Russell to Orleans sts	"	4
"	from Orleans st. to 271 ft. e. of St. Aubin ave	"	6
"	w. from Jos. Campau ave. 300 ft	wood.	2¼
"	from Jos. Campau ave. to 112 ft. w. of McDougall ave	iron.	4
"	w. from Lieb st. 310 ft	wood.	2¼
"	from Woodward ave. to Griswold st	iron.	6
"	from Griswold to First sts.	"	4
"	from First to Second sts	"	6
Woodward ave.,	e. side, s. from Atwater st. 246 ft	"	3
"	w. side, s. from Atwater st. 171 ft	"	4
"	from Atwater st. to Adams ave	"	8
"	from Adams to Baltimore aves	"	10
"	from Baltimore to Pallister aves	"	8
"	from High st. to 200 ft. n. of Canfield ave	"	4
"	from Bagg st. to Edmund pl	"	24
"	alley e. of, from alley s. of Atwater st. to alley s. of Jefferson ave	"	4
"	alley e. of, from alley n. of Jefferson ave. to alley n. of Congress st	"	4
"	alley e. of, from Gratiot ave. to alley s. of.	"	6
"	alley e. of, from Gratiot ave. to alley s. of Witherell st.	"	4

. of, from Elizabeth st. to alley s. of............	iron	8
g Elizabeth st....................................	"	4
lumbia to Montcalm sts........................	"	4
. of, from Atwater st. to alley s. of Jefferson ave.	"	4
of, from alley n. of Jefferson ave. to Larned st.	"	4
. of, from Larned to Congress sts........	"	8
. of, from Congress st. to alley n. of...........	"	4
. of, from alley n. of Michigan ave. to alley s. rk st...	"	4
nd River to Sullivan aves....	"	4



THIRTY-SEVENTH

NUAL REPORT

OF THE

OF WATER COMMISSIONERS

NEW WATER WORKS.

TO THE

ON COUNCIL OF THE CITY OF DETROIT

FOR THE YEAR

1888.

RTY-SEVENTH ANNUAL REPORT

OF THE

d of Water Commissioners

TO THE

OMMON COUNCIL OF THE CITY OF DETROIT

TOGETHER WITH THE

TS OF THE OFFICERS OF THE BOARD

FOR THE YEAR 1888.

DETROIT:
HE DETROIT FREE PRESS PRINTING COMPANY.
1889.

BOA

JACOB S.
AUGUST

WAYS AND
EXTENSIO
SUPPLY O
LICENSED
CLAIMS...

Presiden
Vice-Pre
Secretar
Superint
Enginee

Assessor

Receivi
Reservo

ARD OF WATER COMMISSIONERS,

DETROIT, 1889.

MEMBERS:

FARRAND, 1890.　JOHN PRIDGEON, 1891.
GOEBEL, 1889.　SAMUEL G. CASKEY, 1893.
JOSEPH NAGEL, 1892.

COMMITTEES:

D Means	Commissioners FARRAND, PRIDGEON.
N and Repairs	Commissioners CASKEY, NAGEL.
F Water	Commissioners PRIDGEON, GOEBEL.
Plumbers	Commissioners CASKEY, PRIDGEON.
	Commissioners in Rotation.

OFFICERS:

t	JACOB S. FARRAND.
sident	SAMUEL G. CASKEY.
y	L. N. CASE.
endent	HENRY BRIDGE.
r	JOHN E. EDWARDS.
rs and Collectors	THOS. R. PUTNAM. HARRY S. STARKEY. MAX F. GREUNER. ALBERT W. GOODSELL. ANTHONY T. McLOGAN. F. H. HUTAFF. HARRY L. JAMES.
ng Clerk	GEORGE E. KUNZE.
ir Keeper	WILLIAM N. SANFORD.

TROIT WATER RATES.

From July 1, 1886.

	Per Annum.
mily	$5 00
Houses.—Special rates.	
Stables, for each horse	2 00
Stables, " " "	2 00
nd Team Horses, each	1 00
ach	1 00
and Offices, from	$2 00 to 20 00
s, average daily use, for each bbl. of flour	3 50
, Groceries and Provision Stores, from	$3 00 to 100 00
h faucet, from	8 00 to 50 00
ouses	10 00 to 100 00
er Houses.—Special rates.	
and Taverns, in addition to family rate, each room..	1 00
ng Schools, each room	1 00
Schools, from	$5 00 to 50 00
g Purposes, each 1 M brick	5
" " 100 yards plastering	10
" " perch stone	1¼
g Offices.—Special rates.	
r Stalls, each not less than	3 00
hops, for 10 persons or under	3 00
" for each additional 10 persons	1 00
l quantities of water each 100 gals	2
Rates, each 100 gals	1
ng Houses, in addition to family rate, each boarder..	1 00

FIXTURES.

ubs, for families, 1st tub, $2 00; each additional... ...	1 00
ubs, public, each tub	5 00
Closets, for a family, 1st closet, $3 00; each additional,)	$3 00 to 15 00
Closets for Hotels, Stores, Factories, &c., for rsons, $5 00; each additional person	25
, not less than	2 00
Hand Basins, for family	$1 00 to 3 00
" " " other purposes, each person	25
nent Wash Tubs	2 00
	$3 00 to 30 00
ins	5 00 to 20 00
Sprinklers, each wagon	200 00

there is waste of water a proper increase of rates will be made.

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PORT OF THE COMMISSIONERS.

WATER COMMISSIONERS' OFFICE.

DETROIT, January 2, 1889.

nmon Council:

ard of Water Commissioners herewith submit to
rable body its annual report for the year 1888.
orts of the Secretary, Superintendent, and Mechan-
eer, accompany this report, to which you are respect-
rred for the details of its financial transactions, the
onstruction, and that of pumping water during the

ur last report the Board have experienced the loss by
a faithful and competent official, in the person of its
, Henry Starkey. His natural ability, his general
nce with city matters, and his long continuation in
of Secretary, had rendered him of great value to this
on.
e appointed to fill the office made vacant by his
. L. N. Case, who has been, for twenty-two years, in
y of the Board as Assessor and Collector, and to the
le vacant by this promotion, we have appointed F. H.
ormerly the permit clerk of the office.
nded debt of the Board has decreased $50,000, leav-
is date, $1,327,000 with an annual interest of $83,400,
indebtedness there will mature, August 1, 1890,
The entire debt matures at stated periods, as shown
cretary's report on or before June 1, 1906.
xpenditures for the year were $415,762.13. The
were $436,496.02, showing an excess of the latter over
er of $20,733.89; which, considering the redemption

$50,000 of bonds, the payment of $85,814.90 interest, and
e large expenditure of $155,590.08 in laying iron pipe, most
which was in the new territory recently added to the city,
is hoped indicates such conduct of the Works as will meet
th the approval of your honorable body.

In our last report it was stated that proceedings at law had
en commenced, by which the Board had been prevented from
eiving the money given it by the will of the late Chauncey
rlbut. These proceedings before Judge Hosmer in the Cir-
it Court, resulted in a decision in favor of the Board. The
ntestants however have appealed from this decision, which
peal will be argued by counsel before the Supreme Court,
her this month or in April following; by which it is seen that
early adjustment of the matter can be reasonably looked for.

The construction of a new settling basin at the New Pump-
Works is receiving the necessary consideration from the
ard.

There has been expended, during the past year, $10,495.64,
the construction of a new coal shed, which, together with
it already in use gives the works a storage capacity of
,000 tons.

The providing of an additional engine, which was referred
in our last report, as necessary at no distant day, will prob-
ly have to be done some time during the present year;
ich will require, as was then said, a new structure or an
dition to our present engine house.

The receipts of water rates from the new territory have not
en, nor will be, for some time to come, commensurate with
large expenditure incurred by the Board, in supplying
se districts with the necessary pipeage. The larger number
residents living therein have connected with the pipes, yet
re are still many who continue to use water from wells, the
leterious effects of which have already been commented
on by the press, and received attention from your honorable
dy. It almost seems necessary to this Board that some steps
uld be taken to persuade and influence, if not to compel, a
neral use of water from the Works in these localities.

statement of the expenditures of the Board, e items purchased, and of whom, has already to your honorable body, the vouchers for which, the original bills, are on file in this office.

fully realizes that the needs and necessities of owing city, as regards its water supply, is of par-est to all of its people; and to provide properly ds, with a due regard to economy, will continue to consideration that move your Commissioners.

respectfully submitted.

)
JACOB S. FARRAND,
JOHN PRIDGEON,
MARSHALL H. GODFREY,*
SAMUEL G. CASKEY,
JOSEPH NAGEL,
Board of Water Commissioners.

---

r Godfrey resigned January 7th, 1889, and Col. August Goebel was vacancy.

REPORT OF THE SECRETARY.

DETROIT, January 2, 1889.

Board of Water Commissioners:

TLEMEN—I have the honor to submit the Secretary's for the year ending December 31, 1888.

following is a statement of receipts and disbursements:

RECEIPTS.

RATES ACCOUNT:		
tes paid		$344,315 26
TAGE ACCOUNT:		
m delinquents	$5,386 57	
nalties for shutting	887 75	
		6,274 32
F DETROIT ACCOUNT:		
neral tax levy		70,024 23
ST ACCOUNT:		
posits, general account	$2,762 94	
posits, sinking fund	687 86	
		3,450 80
G WORKS ACCOUNT:		
nt		1,500 00
UMPING WORKS ACCOUNT:		
privilege	$100 00	
ckage	300 00	
ders	155 00	
		555 00
NTS AND METERS ACCOUNT:		
le of meters		124 50
IPE ACCOUNT:		
ying pipe	$1,069 42	
le of materials	132 12	
		1,201 54
PIPE ACCOUNT:		
le of materials		5 80

PUMPING
Sale c
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ACCOUNT:	
ials..............	$18 19
s ACCOUNT:	
....	72 88
ISE ACCOUNT:	
ises.........................	470 00
ACCOUNT:	
rillings......................	7,235 50
NT:	
....	1,240 00
AGON:	
material......................	8 00
ipts.........	$486,496 02

EXPENDITURES.

CONSTRUCTION.

COUNT:		
....	$84,489 84	
ndence..........................	3,855 00	
....	46,960 57	
g pipe..........................	60 00	
....	467 59	
terials, stationery, etc...........	97 50	
nps, and other materials..........	500 61	
....	2,875 62	
' tickets........................	30 00	
....	181 89	
....	54 00	
....	23 60	
;..............................	1,358 54	
....	12,060 54	
and freight.....................	1,781 49	
g..............................	25 38	
to laborer and horse.............	45 00	
....	178 39	
r..................	408 00	
....	5 00	
....	131 52	
		$155,590 08

p Cocks Account:

Valves	$2,588 88	
Labor	2,232 65	
Repairs	135 51	
Lumber	56 36	
Boxes	1,114 62	
Tools, nails, and other materials	53 70	
		$6,181 72

drants and Meters:

Meters	$448 75	
Tools	13 85	
Materials	2 66	
Repairing	9 04	
		474 30

w Pumping Works Account:

Repairs and building material	$1,597 64	
Labor	2,129 30	
Stove	9 70	
Tools	99 78	
Trees	8 75	
New coal house	10,495 64	
New conduit pipe	2,041 16	
		16,381 97
Total construction expenses		$178,628 07

OPERATING EXPENSES.

mping Water Account:

Coal	$43,091 84	
Handling coal	2,649 35	
Coke	147 18	
Diving	185 00	
Engineers and firemen, and other labor	17,502 76	
Lights	361 82	
Lubricators	204 33	
Repairs	1,784 26	
Supplies, such as packing, waste, and rags	559 85	
Supplies, tools, rakes, etc	109 54	
Freight, teaming, and livery	7 89	
		$66,603 82

c..................	$104 76	
....	115 00	
....	7,745 63	
		$7,965 39
....		272 65
....	$392 94	
....	57 19	
....	457 50	
....	21 00	
		928 63
clerks.............	$13,735 18	
g..................	364 09	
etc................	352 34	
ice, etc...........	182 96	
ery, etc...........	693 64	
....	232 48	
....	402 48	
....	160 95	
....	45 00	
....	600 00	
....	80 00	
....	794 25	
rs)................	34 65	
....	19 25	
		17,697 27
ors...............	$2,460 00	
....	119 94	
....	1,596 90	
		4,176 84
T:		
....	$104 07	
....	691 66	
....	221 53	
....	1,433 50	
....	103 80	
		2,554 56

CENTAGE ACCOUNT:

Labor shutting off	$820 00
Total operating expenses	$101,019 16
Total construction	178,628 07
Interest on bonded debt	85,560 00
Bonds paid	50,000 00
Premium on bond paid	254 90
	$415,462 13
Add amount paid librarian of the Hurlbut library	300 00
Aggregate expenditures for 1888	$415,762 13

STATEMENT.

on hand January 1, 1888	$64,754 57	
ipts, 1888	436,496 02	
		$501,250 59
ended in 1888	$415,762 13	
on hand January 1, 1889	85,488 46	
		$501,250 59

he value of the Works January 1, 1889, estimated in the mer as heretofore, is $4,267,149.23. It would be well, and Superintendent and myself have it in contemplation, to e a complete and perfect estimate, some time during the ent year, based upon the actual property in existence, with r present valuation.

onded Indebtedness is $1,327,000.

expended for the New Works to January, 1889,

	Expended Previously.	1888.	Total.
....	$35,000 00	.. ..	$35,000 00
....	608,677 14	....	608,677 14
....	51,356 97	....	51,356 97
anals......	123,912 78	....	123,912 78
luit wells...	42,162 81	2,041 16	44,203 97
coal house.	146,802 34	13,069 56	159,871 90
ower.......	30,420 72	....	30,420 72
....	54,221 56	....	54,221 56
....	265,642 24	....	265,642 24
....	44,248 40	....	44,248 40
....	7,773 14	....	7,773 14
....	3,666 25	....	3,666 25
....	43,831 15	1,361 55	45.192 70
....	2,977 86	....	2,977 86
....	8,721 25	9 70	8,730 95
	$1,469,414 61	$16,481 97	$1,485,896 58

BONDED INDEBTEDNESS.

ng is a statement of the present bonded debt:

ISSUED.	PAYABLE.	Rates of Interest.	Annual Interest.
August 1, 1868	August 1, 1888	7%	$70 00
August 1, 1855	August 1, 1890	7%	6,790 00
August 1, 1858	August 1, 1893	7%	3,220 00
August 1, 1859	August 1, 1893	7%	3,500 00
August 1, 1860	August 1, 1893	7%	3,500 00
Dec'r 1, 1881	Dec'r. 1, 1896	4%	2,000 00
Sept'r 1, 1880	Sept'r 1, 1899	4%	4,000 00
April 1, 1881	April 1, 1899	4%	4,000 00
Feb'ry 1, 1870	Feb'ry 1, 1900	7%	7,000 00
August 1, 1872	August 1, 1902	7%	3,500 00
August 1, 1873	August 1, 1903	7%	3,500 00
Feb'ry 1, 1874	Feb'ry 1, 1904	7%	3,080 00
August 1, 1874	August 1, 1904	7%	16,870 00
June 1, 1875	June 1, 1905	7%	10,430 00
June 1, 1876	June 1, 1906	6%	11,940 00
			$83,400 00

f the bonded debt, $49,000 maturing August 1, 1888, were
ented and paid. One $1,000 bond due June 1, 1906, bear-
six per cent. interest was purchased at a proper premium.

SINKING FUND.

y the Act authorizing the $1,000,000 loan of 1873, of the
unt paid to the Board from the city treasury, $20,024.23
t be placed in the sinking fund for the payment of out-
ding indebtedness.

WATER RATES.

he annual assessment of rates for the year ending July 1,
), was $332,342, an increase over the previous year of
018. The rates collected for the year ending December
1888 (including meters, $9,175.17) was $344,315.26, an
ease over previous year of $21,480.67.

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ASSESSMENT FOR 1888-9.

Families.			Tenements Vacant.	Increase Assessed.	Assessment.	
Assessed.	Not Assessed.	Whole Number.			1888-9.	Increase.
2,638	7	2,645	12	119	$21,944	$1,354
3,846	5	3,851	20	193	24,177	1,362
6,484	12	6,496	32	312	46,121	2,716
2,894	3	2,897	44	−7	21,265	324
3,172	2	3,174	27	110	25,021	646
6,066	5	6,071	71	103	46,286	970
2.188	....	2,188	50	59	38,575	997
1,990	....	1.990	54	9	44,644	1,320
4,178	....	4,178	104	68	83,219	2,317
2,563	....	2,563	49	99	27,155	1,540
2,882	9	2,891	40	104	22,129	1,278
5.445	9	5.454	89	203	49,284	2,818
2,553	7	2,560	26	150	19,436	1,650
3,200	16	3,216	22	194	22,731	1,464
2,347	10	2,357	18	171	16,636	854
8,100	33	8,133	66	515	58,803	3,968
2,561	13	2,574	15	152	16,229	990
1,416	19	1,435	13	106	9,667	764
1,077	189	1,266	19	742	11,411	4,387
678	695	1,373	9		4,416	
806	101	907	13	164	5,605	1,053
52	....	52	....	12	1,301	35
6,590	1,017	7,607	69	1,176	48,629	7,229
36,863	1,076	37,939	431	2,377	$332,342	$20,018

RECEIPTS OF WATER RATES.

Assessments.	First District.	Second District.	Third District.	Fourth District.	Fifth District.	Sixth District.	Aggregate.
1876-7...	$6 00	....	....	....	....	....	$6 00
1883-4...	....	$1 50	....	....	$5 00	....	6 50
1884-5...	....	12 00	$12 00	$4 50	23 00	....	51 50
1885-6...	....	14 00	15 75	....	10 50	....	40 25
1886-7...	29 50	84 75	104 00	52 25	35 25	....	305 75
1887-8...	22,166 97	22,690 51	41,226 41	25,068 63	30,137 95	$22,118 00	163,408 47
1888-9...	24,625 41	24.595 80	46,178 81	26,185 89	32,971 21	25,954 67	180,511 79
Totals..	$46,827 88	$47,383 56	$87,536 97	$51,311 27	$63,182 91	$48,067 67	$344,315 26

WORK OF THE INSPECTORS FOR THE YEAR 1888.

	Calls for Non-Payment.	Shuts for Non-Payment.	Examined New Connections.	Let on New Connections.	Notified for Stop Boxes.	Notified for Building Tax.	New Box Put in.	Shut for Building Tax.	Shut for Vacancy.	Located Stop Boxes.	Shut New Houses when Completed.
John Wallace........	623	340	875	885	225	52	....	....	....	....	....
John Becker........	1,110	672	454	276	195	77	93	3	47	40	....
Michael Hart........	599	640	446	406	165	59	....	2	....	17	56
John Hatzenbuhler........	793	329	875	823	185	90	143	....	50	....	....
	3,125	1,981	2,650	2,390	770	278	238	5	97	57	56

The work performed by the Inspectors cannot be too highly appreciated. Coming directly, as they do, in contact with the people, and in what must seem to the latter an offensive manner, and in the performance of disagreeable duties, yet such has been the general courtesy with which they have performed those duties that but very few complaints have been made against them.

In connection with the work performed, as shown in the above diagram, each Inspector keeps a book of record in which is a perfect description of all property in their several districts,

e location of the "stops' for each pipe leading
ent premises. I take great pleasure in recom-
officials to your favorable consideration.

g is an exhibit of the assessments and collection
for several years—the former commencing in
in January:

	Year.	Assessment.	Collection.	Year.	Assessment.	Collection.
18	1865	$77,212 00	$84,041 21	1877	$205,603 00	$210,288 12
8	1866	83,641 00	88,044 80	1878	203,229 00	208,193 95
0	1867	96,678 00	98,428 18	1879	208,666 00	218,110 13
94	1868	105,752 00	106,399 14	1880	220,538 00	227,452 73
5 25	1869	115,252 00	118,068 29	1881	233,657 00	241,844 32
2 20	1870	130,301 00	127,143 61	1882	253,583 00	261,725 79
9 04	1871	141,003 00	138,325 87	1883	270,019 00	280,049 06
4 90	1872	151,928 00	155,536 98	1884	293,998 00	300,467 24
0 01	1873	168,247 55	167,022 00	1885	298,860 00	313,205 10
5 82	1874	182,308 75	183,323 27	1886	286,979 00	314,954 21
8 98	1875	195,110 75	195,908 64	1887	312,324 00	332,834 59
5 42	1876	208,876 50	205,624 74	1888	332,342 00	344,315 26

close the year 1888 with a balance on hand of
excess over that of one year ago of $20,733.89.
ling the fact that during the year $50,000 of
deemed, a new coal shed costing $10,495.64, and
t pipe costing $2,041.16 were built.
97,000 bonds falling due August 1, 1890, none in
ear.
s for water rates for the coming year may safely
to exceed those of last year by $20,000, which
amply provide for the obligations of the Board,
em to make such improvements as in their judg-
ssities of the supply of water demand.
h is respectfully submitted.

L. N. CASE,
Secretary.

REPORT OF EXPERT ACCOUNTANTS.

WATER COMMISSIONERS' OFFICE,

DETROIT, January 8, 1889.

the Honorable Board of Water Commissioners of the City of Detroit:

GENTLEMEN—We have carefully examined the vouchers and oks of the Water Works from January 1st to December 31st, 88, and report them to be correct. We find:

sh on hand in office	**$4,942 59**
sh in bank, credit General Fund	**80,545 87**
Total January 1, 1889	**$85.488 46**

'hich is correct.

Respectfully submitted,

F. L. SEITZ,
JOHN HOSMER,
Committee

T OF THE MECHANICAL ENGINEER.

DETROIT, January 1, 1889.

d of Water Commissioners:

MEN—I have the honor to submit the Engineer's re-
e year 1888.

lowing table shows the number of gallons of water
nd cost of fuel for the years named.

R.	Gallons of water pumped.	Cost of fuel consumed.	Average daily delivered.
....	235 840,271	....	646,411
....	303 531 743	$ 2,129 37	931,594
....	376 265 126	2,271 34	1,030,866
....	542 807,364	3,325 81	1,487,143
....	692 124,305	4,017 44	1,896,231
....	697 190,523	3,993 20	1,909,837
....	718 091,207	3,655 20	1,967,373
....	782 112,587	3,194 15	2,142,774
....	870 036,451	4,196 21	2,383,580
....	895 129,423	4,414 07	2,452,409
....	994 945,329	3,150 95	2,725,878
....	1,035 798,043	4,670 86	2,837,803
....	1,018 390,256	7,647 62	2,839,078
....	1,049 514,887	7,372 89	2,875,383
....	1,196 317,922	9,349 16	3,277,583
....	1,425 535,230	10,121 82	3,905,576
....	1 666 545,125	11,379 23	4,507,248
....	1 646 810,325	11,247 92	4,511,809
....	1 866 060,068	12,713 78	5,112,493
......	2,300 150,605	14,681 05	6,301,782
......	2 782 292,578	17,736 86	7,601 892
......	3 198,393,948	20,233 30	8,762,723
......	3 289 872 635	20,431 71	9,013,350
......	4 207,454,260	21,393 98	11,527,272
......	4,065 134,470	19,832 89	11,107,499
......	4 213,239 790	17,433 72	11,543,123
......	4 345 743,330	10,943 82	11,906,146
......	5 129 599 110	11,219 51	14,053,696
......	5 552 965 310	12,276 60	15,172,036
......	6 543, 27 968	16,556 63	17,926,377
......	6 284 000,742	13,156 16	17,261,440
......	7 379 327.188	16,495 99	20,217,334
......	8 510 614, 40	19,877 07	23,253,044
......	9 970 829,580	21,341 48	27,317,341
......	10 576 571,254	20,387 24	28,976,907
......	13 168 895,808	35,882 83	36,079,166
......	14 380 166,670	39,568 66	39,397,716

ENGINE NO. 1.

MONTHS.	Time run. H.	Time run. M.	Revolutions.	Gallons.	Cost of Kindling.	Pounds of Coal.	Cost of Coal.	Pounds of Coke.	Cost of Coke.	Total Cost.	Duty.	No. gals. with 1 lb. coal.
January	744	....	432,601	669,666,348	$5 63	795,783	$1,786 53	....	....	$1,792 16	74,573,706	841
February	696	....	397,084	614,686,032	5 63	710,850	1,595 85	....	....	1,601 48	79,329,399	864
March	744	....	418,986	648,590,328	3 75	762,953	1,712 82	....	....	1,716 57	77,988,652	850
April	528	....	268,173	415,131,804	1 88	425,732	955 76	61,325	$147 18	1,104 82	77,271,331	857
May	360	....	171,515	265,505,220	3 75	331,266	743 25	....	....	747 00	73,528,869	801
June	720	....	361,555	559,687,140	1 88	669,334	1,495 96	....	....	1,497 84	76,711,624	836
July	480	..	230,053	356,122,044	1 88	423,010	945 42	....	....	947 30	77,233,720	841
August	360	....	175,765	272,084,220	....	323,534	723 09	....	....	723 09	77,151,107	840
September	720	....	347,424	537,812,352	....	680,449	1,520 80	....	....	1,520 80	73,827,687	790
October	528	....	262,909	304,504 758	....	401,968	898 38	....	....	898 38	72,655,164	749
November	720	....	327,951	507,668,148	....	649,646	1,451 95	....	....	1,451 95	74,215,915	780
December	744	....	347,279	537,587,892	3 75	687,058	1,535 57	....	....	1,539 32	73,087,002	782
Total	7,344	....	3,741,295	5,689,046,286	$28 15	6,861,583	$15 365 38	61,325	$147 18	$15,540 71	....	....

ENGINE No. 2.

MONTHS.	Time run. H.	Time run. M.	Revolutions.	Gallons.	Cost of Kindling.	Pounds of Coal.	Cost of Coal.	Pounds of Coke.	Cost of Coke.	Total Cost.	Duty.	No. gals. with 1 lb. coal.
January	744	....	425,865	684,790,920	$7 50	805,317	$1,807 93	....	....	$1,815 43	76,414,064	850
February	696	....	412,781	663,751,848	7 50	820,386	1,841 76	....	....	1,849 26	74,224,321	809
March	216	....	127,957	205,754,856	3 75	248,326	557 49	....	....	561 24	76,012,783	828
April	384	....	222,215	263,416,932	3 75	324,024	727 43	....	....	731 18	73,224,483	812
May	696	....	389,665	443,193,744	3 75	544,625	1,222 18	....	....	1,225 93	74,654,293	813
June	600	....	314,007	504 923,256	1 88	616,006	1,376 77	....	....	1,378 65	75,196,766	819
July	284	....	135,681	218,175,048	1 88	260,108	581 34	....	....	583 22	76,950,266	838
August	432	...	260,989	263,007,696	....	321,171	717 82	....	....	717 82	75,125,402	826
September	720	....	371,059	596,662,872	....	742,655	1,659 83	....	....	1,659 83	75,045 728	803
October	624	....	346,239	457,751,772	....	590,258	1,319 23	....	....	1,319 23	74,005,174	775
November	720	....	358,067	575,771,730	....	731,970	1,635 95	....	....	1,635 95	74,787,318	786
December	432	....	218,913	352,012,104	1 88	456,163	1,019 52	....	....	1,021 40	72,081,134	771
Total	6,548	....	3,583,438	5,229,212,784	$31 89	6,461,009	$14,467 25	....	....	$14,499 14	....	....

	H.	M.										
January												
February												
March	528		290,489	522,880,200	$3 75	647,185	$1,452 93			$1,456 68	68,057,287	807
April	528		272,825	491,085,000	3 75	596,469	1,339 07			1,342 82	74,158,100	823
May	432		242,233	436,019,400	3 75	539,117	1,210 81			1,214 06	74,196,175	808
June	120		58,895	106,011,000	1 88	124,265	277 73			279 61	78,268,784	853
July	744		354,062	637,311,600	3 75	766,219	1,712 49			1,716 24	76,305,816	831
August	696		362,346	652,222,800		789,398	1,764 29			1,764 29	75,798,644	826
September												
October	336		188,014	338,425,200		434,495	971 09			971 09	74,703,646	778
November												
December	312		154,418	277,952,400	3 75	349,115	780 27			784 02	74,367,981	796
Total	3,696	..	1,923,282	3,461,907,600	$20 63	4,246,258	9,508 18			$9,528 81		
Aggregate	17,588		9,248,015	14,380,166,670	$80 67	17,568,850	$39,340 81		$147 18	$39,568 66		

Fuel consumed	$39,568 66
Salaries Engineers, Firemen, Coal Passers and other labor	17,502 76
Lubricators	204 33
Repairs	1,784 26
Supplies, packing, rags, boiler compound, etc	559 85
Tools and Utensils	109 54
Submarine Diver, cleaning strainers	185 00
Lights	361 82
Freight and teaming	7 89
Total	$60,284 11

Cost per million gallons, $4.19.

It will be seen from the tables showing the annual consumption of water the great increase in demand. The amount used in 1888 more than in 1887 is 1,211,270,862 gallons, being more water than the city used during the year 1866, or as much as the average pumped in one month in 1888. It is clear that for the safety of the city the pumping capacity should be increased in the same ratio as the demand for water. This showing confirms the statement I made in my last report as to the necessity of another engine in the not distant future. I would also suggest that two expert engineers be sent by the Board to such cities as are known to be using pumping engines on the triple expansion principle, for the purpose of making examinations and inquiries as to economy, arrangement of cylinders, etc., so that your Honorable Board may be better able to form an opinion from their report as to the style of engine best adapted to our requirements.

I am glad to be able to report that the engines are in good working order. Our boilers have been undergoing quite extensive repairs. Since the high pressure required to force the water through one main while the other was shut off at the Belt Line crossing, it will be necessary to take the tubes from the eight boilers, clean, lengthen, and replace them, before the boilers will be in good order, as the tubes have a covering of scale which is very much against the duty of the boilers. I notice the abutments of the Belle Isle bridge stops the ice and leaves a cover over the strainers with a lighter ice much sooner than ever before, which lessens the danger of anchor ice. With our new conduit, I think we are safe from further danger of anchor ice.

Respectfully submitted.

JOHN E. EDWARDS,
Engineer.

RT OF THE SUPERINTENDENT.

DETROIT, January 2, 1889.

of Water Commissioners:

EN—In accordance with the regulations of your ody, I have the honor to present my annual report he general condition of the work and the progress department.

ie past year over 29 miles of pipe were laid, 1¼ ch was taken up and relaid to a greater depth, and e of iron and 6¾ miles of wood pipe were replaced pe of much larger size.

ge system is being greatly improved by the rapid- ich the wooden logs, and some of the smallest lines e, are being replaced with pipe of much larger

e past year the 24-inch main in Vinewood Ave. was m Michigan Ave. to Fort St., a distance of 6864 in connection with our 30 and 42-inch mains, mplete line around our City from the Pumping ere is now laid of our large mains, 8½ miles of 42- s of 30-inch, and 9½ miles of 24-inch, to which d the smaller size mains. Clinton St. and Gratiot 8-inch lines, were connected with the 30-inch main , also the 6-inch in St. Aubin Ave. to the 42-inch mont St. the past year, the connecting of which improved the head and general distribution: 688 ch main was laid in the Reservoir grounds connect- ich main entering the grounds from Scott St. to St. line of 24-inch main, this makes a complete uit between the south 24-inch and the north 30-inch mains ;he reservoir grounds.

he lowering of the 42-inch main in Jefferson Ave. crossing M. C. Belt Line was very successfully accomplished not- ıstanding the continual passing of the gravel trains above heads, and some very unpleasant weather while the work in progress. Two 8-inch connections were made from the 42-inch main to the 6-inch line in Jefferson Ave. on either of the Belt line, the said 6-inch pipe having been discon- ıed crossing the Belt line.

PIPEAGE.

he amount of iron pipe laid and re-laid, and iron and wood ɜ discontinued during the past year, in connection with the ribution, is as follows: Iron pipe laid and relaid 29 730/5280 ɜs. There have been 6 3867/5280 miles of wooden logs, and 1 62/5280 ɜs of iron pipe discontinued, and 1 951/5280 miles lowered, mak- the net increase of pipeage 20 1134/5280 miles. This amount, ed to the measured lines of pipe and logs connected with works, would make the total pipeage of the city 343 396/5280 ɜs, of which 301 2460/5280 miles is iron pipe, and 41 3216/5280 miles are ıden logs, which in detail is as follows:

Iron pipe	45	inch diameter	103	feet.
"	42	"	44,849	"
"	30	"	32,400	"
"	24	"	49,693	"
"	20	"	461	"
"	18	"	87	"
"	16	"	1,552	"
"	12	"	1,973	"
"	10	"	82,029	"
"	8	"	140,716	"
"	6	"	534,245	"
"	4	"	615,637	"
"	3	"	87,995	"
Total feet			1,591,740	

42
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IRON PIPE LAID IN 1888.

iameter	138 feet.
	7,552 "
	4,195 "
	4,523 "
	65,178 "
	71,459 "
	809 "
	153,854

he past year 450 stop gates have been set and reset
n with the distribution pipes and mains of the fol-
ls and sizes:

NAMES OF GATES.	Diameter in inches.	Remarks.
urdock Valve Co., Detroit	24	Set.
lowers. Bros	24	Reset.
alvin	10	"
urdock Valve Co., Detroit	10	Set.
" " " "	8	"
" " " "	6	"
" " " "	4	"
" " " "	4	For blow off.
" " " "	6	" "
ddy	6	" "
lowers Bros	4	" "
" "	3	" "
ttsburgh	4	" "
"	4	Reset.
owers Bros	4	"

now connected with the water mains 1571 fire hy-
342 cisterns; 193 hydrants and 30 cisterns were
st year.

umber of service connections with iron pipe and
is shown in the following table:

ections with iron pipe	6,317
ch	25,141
	356
e inch	7
	31,821
den logs	4,788

REPAIR DEPARTMENT.

The work in the repair and tapping department has received rompt attention; over 3,600 taps were made with the distriution pipes, of sizes from 0⅝ to 3 inches during the time limited ›r this work.

OFFICE BUILDING.

The roof of this building has received an entire new coverıg of the Gilbertson old method IX. roofing tin, replacing the ld tar and gravel covering, which was so defective.

INLET CONDUIT.

The building of a third conduit was completed the past sea›n; leading from the river to the settling basin, this is built earer the surface with the view of avoiding as much as possile the inflow of needle ice, and where it can readily be got at ›r clearing away the said needle ice.

The strainers of the two inlet pipes have received a thorough xamination and cleaning, a submarine diver having been sent own to examine them and to execute such other work necesıry to a better inflow.

COAL SHED.

The taking down of the west coal shed and rebuilding of another, larger, was accomplished the past season. We have ow a storage capacity for coal of ten thousand tons.

In closing this report it is only courteous to say, that there as been harmonious co-operation with the officers of the other oards of our City.

Transmitted with this report are the locations of pipes and ates, also inventory of pipe, special castings, and tools on hand, anuary 1st, 1889.

HENRY BRIDGE,
Superintendent.

EAGE OF THE CITY OF DETROIT.

BY STREETS SHOWING THE KIND AND SIZE OF THE IRON PIPES AND WOODEN LOGS NOW IN USE.

LOCATION.	KIND.	DIAM. INCHES.
inewood ave.. 439 feet	iron	4
Cass to Tenth st	"	24
s. of from Cass to e. line of Lognon farm	"	4
n. of First st. to Twelfth st	"	4
Jefferson ave. to Wight st. s. of, 424 feet	"	4
m John R. to Randolph st	"	6
m Witherell to Hastings st	"	4
ey s. of, from 240 feet e. of Clifford to Cass st	"	4
ey n. of, from Woodward to Cass ave., w. 100 feet	"	4
m Woodward ave. to Brush st	"	4
m Brush st. e. 120 ft	wood	3
m 120 ft. e. of Brush to St. Antoine st	iron	4
m St. Antoine to Hastings st	wood	2¼
m Hastings to Orleans st	iron	4
m Orleans st., e. 36 ft	"	18
m Orleans st. to Gratiot ave	"	10
e., crossing Third ave	"	4
e., from Cass ave. to Third st	wood	3
e., from Cass ave. to Brush farm	iron	4 & 6
e., alley n. of, from Crawford st. to Jones farm	wood	2¼
e., from Sixth to Seventh st	"	2¼
e., crossing Seventh st	iron	4
e., crossing Sixth st	"	4
e., from Fourth to Crawford st	"	3 & 4
w. of Beaubien st., 195 ft	"	4
from Beaubien to St. Antoine st	"	3
from St. Antoine to Rivard st	wood	3
, from 325 ft. e. of Russell to Rivard st	"	2¼
, crossing St. Antoine st	iron	4
, crossing Hastings st	"	4
, crossing Rivard st	"	4
, crossing Russell st	"	4
, from Dequindre st. to alley w. of Dubois st	"	4
, Orleans st. w. of, 260 ft	"	4
, Moran st. from 401 ft. e. to 531 ft. w. of	"	4
, from 155 ft. w. of Dubois to 63 ft. e. of Chene st	"	3
, crossing Grandy ave	"	3
, 570 ft. w. of Grandy ave	wood	3
, 184 ft. e. of Collins st. to 287 ft. w	iron	4
Voodward ave. to Rivard st	"	4
ussell to Rivard st	wood	2¼
ussell to Orleans st	iron	3
rleans to Dubois st	"	4
Junction ave. 558 ft. e. of	"	4
Junction w. 400 ft	"	4
m 462 ft. w. of Russell st. to 22 ft. w. of McDougall ave	"	4
. of Second st. 41 ft	wood	2¼
. of Second st. 165 ft	iron	3
w. of Twelfth st. 193 ft	"	4
ratiot ave. to 275 ft. e. of Jos. Campau ave	wood	2¼
75 ft. e. of Jos. Campau ave. to alley w. of McDougall	iron	3
g Jos. Campau ave	"	4
lmwood ave. to Mt. Elliott ave	"	4
lmwood ave. to alley e. of McDougall ave	"	3
ossing Woodbridge st	"	6
mboldt to Sullivan ave	"	4
of Sullivan ave	"	3
man ave. to Twenty-third st	"	4
Vinewood ave	"	6
ewood ave. to Twenty-seventh st	"	4

LOCATION.	KIND.	DIAM. INCHES.
sh st., crossing Tillman ave	iron	4
sh st., crossing Twenty-fourth st	"	4
sh st., crossing Seventeenth st	"	4
sh st., east of Maybury ave. 250 ft	"	4
sh st., west of Wabash ave., 148 ft	"	4
sh st., crossing Eighteenth st	"	4
sh st., from Seventeenth to Eighteenth st	"	3
sh st., e. of Humboldt ave. 166 ft	"	3
sh st., from alley e. of Trumbull ave. to Grand River ave	wood	2¼
sh st., from Harrison ave. to alley e. of Wabash ave	"	2¼
sh st., from National ave. to alley w. of Trumbull ave	"	3
sh st., from Twenty-third to Twenty-fourth st	"	2¼
twater st., from Griswold to Bates st	iron	6
twater st., from Griswold to Shelby st	"	3
twater st., alley s. of, from Randolph st. to alley w. of Bates st	"	4
twater st., Randolph st. to St. Aubin ave. e 215 ft	"	4
twater st., from 215 ft. e. of St. Aubin to McDougall ave	"	6
urelia st., crossing Vinewood ave	"	4
urelia st., crossing Twelfth st	"	4
urelia st., from Twelfth st. w	wood	2¼
. st., 313 feet west of Vinewood ave	iron	4
agley ave., from Park to Clifford st	"	4
agley ave., alley w. of, from 230 ft. n. of Clifford st. to Grand River ave	"	4
agley ave., alley e. of, from alley n. of Park st. to Cass ave	"	4
agg st., from Fifth to Crawford st	wood	2¼
agg st., from Woodward ave. to Fifteenth st	iron	24
aker st., from Seventh to Eighth st	"	4
aker st., from Seventh to Twenty-fourth st	"	8
aker st., from Twenty-fourth st. to Vinewood ave	"	4
aker st., crossing Vinewood ave. 29 ft	"	6
aker st., from Hubbard to Scotten ave	"	4
aldwin ave., from Jefferson ave. to Linden Park ave	"	6
aldwin ave., crossing Mack Road	"	10
altimore ave., from Woodward ave. to Brush st	"	3
altimore ave., from Woodward ave. to Crawford st	"	4
ates st., from Atwater st. to Farmer st	"	6
eech st., from First to Seventh st	"	4
eech st., alley s. of, from Sixth st. to alley w	wood	2¼
eacon st., from Brush to St. Antoine st. e. 211 ft	iron	4
eaubien st., from Atwater to Clinton st	"	6
eaubien st., from Clinton to Watson st	"	4
eaubien st., from Watson st. to Harper ave	"	10
eaubien st., from Harper ave. to Boulevard	"	6
eaufait ave., from Jefferson ave., n. 585 ft	"	6
eaufait ave., from 600 ft. n. of Jefferson ave. to St. Paul st. n. 282 ft.	"	4 and 6
eaufait ave., from Mack st. to 777 ft. n. of Sylvester st	"	6
ellevue ave., crossing Mack road to Pulford ave	"	6
ellevue ave., n. of Sylvester st. 348 ft	"	6
ellevue ave., north of Gratiot ave. 2162 ft	"	4
ellevue ave., crossing Gratiot ave	"	6
ellevue ave., from Jefferson ave. n. 3,400 ft	"	6
ellair st., crossing Russell st	"	4
ellair st., from Riopelle st. to St. Aubin ave	wood	2¼
ellair st., from Jos. Campau ave. to Chene farm	"	2¼
ellair st., from 100 feet w. of Dubois to Grandy ave	iron	3
ellair st., from 300 feet e. of St. Aubin ave	"	4
ellair st., McDougall ave., 402 feet e. of	"	4
enton st., e. of Brush st., 143 ft	"	4
enton st., from Brush farm to Russell st	wood	2¼
enton st , crossing Russell st	iron	4
enton st., crossing Hastings st	"	4
erlin st., from Mt. Elliott ave. to Ellery st	"	4
erlin st , crossing Elmwood ave	"	4
erlin st., from Elmwood to alley e. of McDougall ave	"	3
erlin st., from Jos. Campau ave. to alley w. of McDougall ave	wood	2¼
erlin st., from Gratiot to Jos. Campau ave	iron	3
erlin st., crossing Jos. Campau ave	"	4
oulevard north, from Woodward ave. to Russell st. s. side	"	4
oulevard north, crossing Grand River n. side	"	4
oulevard north, crossing Grand River s. side	"	4
oulevard west, crossing Fort st. e. side	"	4
oulevard west, crossing Fort st. w. side	"	4
oulevard west, s. of Porter st., 560 ft	"	4
oulevard west, from Baker st. to Shady Lane	"	3

LOCATION.	KIND.	DIAM. INCHES.
ve., 308 ft	iron	4
rd ave. to Beaubien st	"	6
to Fourth st	wood	2¼
o Third ave	iron	4
to Seventh st	wood	3
st. to alley w	"	2¼
ord st. to Fourth ave	iron	3
venth st	"	4
th st	"	4
ard ave. to Junction ave	"	4
ft. e. of Seventeenth to Eighteenth st	"	4
newood ave., 156 ft	"	4
to Beaubien st	wood	3
ien to St. Antoine st	iron	4
toine to Russell	wood	2¼
lle to Orleans	iron	4
ndre st. to Gratiot ave	"	4
enty-second st. e. 240 ft	wood	2¼
Twenty-second st	iron	4
th st. 284 feet e. of	"	4
to Eighth st	"	4
coln ave	"	4
elfth st	"	4
to Grand River ave	"	30
ty-second st. e. 240 ft	wood	2¼
venty-second st	iron	4
st. to Jefferson ave	"	6
ave. to Congress st	"	4
st. to Gratiot ave	"	8
ve. to Wilkins st	"	4
o Edmund place	"	24
n st. 36 ft	"	6
to Benton st	"	6
st	"	4
na st	"	4
f, from Fort st. to alley s	"	4
e to Milwaukee	"	3
vaukee ave. to 251 feet n	"	4
to Horton ave	"	4
st., 132 feet	wood	2¼
ury to 75 feet e. of Sullivan ave	iron	3
aybury ave	"	4
teenth st. to 387 feet w. of Humboldt ave	"	4
nteenth st. 169 feet	"	4
of Wabash ave	"	4
wenty-fourth st	"	4
d River to Vinewood ave	"	30
en ave. to Twenty-ninth st	"	4
th st. to alley e. of Trumbull ave	wood	2¼
w. of Trumbull to National ave	"	2¼
enth to Twenty-fourth st	iron	24
sh ave. 263 feet	"	4
ury ave. 227 feet	"	4
. 432 feet	"	4
works to Mack road	"	42
feet n. of Jefferson ave. n. 1050	"	6
tes st. to Monroe ave	"	6
f, from Bates st to alley w	"	4
f, from Randolph to alley w. of Bates st	"	4
dre st. to 306 feet e. of Chene	wood	2¼
e. of Chene st. to Grandy ave	iron	3
ne st. e. side	"	4
le st. 159 feet	"	4
to Russell st	"	4
ridge to Fort st	"	6
. 340 ft	"	4
st. 250 ft. n. to 324 ft. s. of	"	6
Dix ave	"	6
r st. to Driggs st	"	6
do ave. to s. of L. S. R. R	"	6
to Woodward ave	"	30
to Woodward ave	"	4
ford st. to Fourth ave.	"	4
enth st. 48 feet	"	4
to Seventh st	"	3

LOCATION.	KIND.	DIAM. INCHES.
Canfield ave., from Twelfth to 48 feet e. of Thirteenth st	iron	3
Canton ave., crossing Mack road	"	6
Caroline st., w. of Twelfth st. 192 feet	"	3 & 4
Cass st., from Woodbridge st. to Jefferson ave	"	8
Cass st., from Jefferson ave. to Joy st	"	10
Cass st., from alley n. of Howard st. to alley s. of Michigan ave	"	4
Cass st., from Spencer st. to alley n. of Michigan ave	"	4
Cass ave., from Joy st. to Alexandrine ave	"	8
Cass ave., from Alexandrine ave. to Holden pl. n. of, 519 feet	"	6
Cass ave., crossing Canfield ave	"	8
Cass ave., alley w. of s. of Gilman st. 119 ft	"	3
Cass ave., from alley n. of Adams ave. to 119 ft. s, of Gilman st	"	4
Cass ave., alley w. of, from Ledyard to Bagg st	wood	2¼
Catherine st., crossing Rivard st	iron	6
Catherine st., from Gratiot ave. to Dequindre st	"	4
Catherine st., from Dequindre st. to St. Aubin ave	"	3
Catherine st., from St. Aubin to Elmwood ave	"	4
Cavalry ave., crossing Dix ave. to 188 ft. s. of Cadet ave	"	6
Cavalry ave., from Dix ave. to Toledo ave	"	4
Celia st., from Wabash ave. to Twelfth st	"	3 & 4
Champlain st., from Randolph st. to alley e	"	4
Champlain st., from Mt. Elliott ave. to Helen st	"	4
Champlain st., from Field ave. to E. Boulevard	"	4
Champlain st., from Elmwood ave. to 250 feet w. of Lieb	"	4
Champlain st., from St. Antoine to Orleans st	"	4
Champlain st., Orleans st. to Elmwood ave	"	6
Champlain st., from Lieb st. to Mt. Elliott ave	wood	2¼
Champlain st., w. of Lieb st. 250 feet	iron	3
Champlain st., alley n. of, from Brush to St. Antoine st	"	4
Charles st., from Sixth to Seventh st	wood	2¼
Charlevoix st., from Jos. Campau ave. to alley w. of McDougall ave	iron	3
Charlevoix st., crossing Jos. Campau ave	"	4
Charlevoix st., from Chene st. to Jos. Campau ave	wood	2¼
Charlevoix st., e. of alley e. of McDougall ave. 86 feet	"	3
Charlevoix st., e. of alley e. of McDougall ave. 84 feet	iron	3
Charlevoix st., from 84 feet e. of alley e. of McDougall to Elmwood ave. 468 feet	"	4
Charlotte ave., from Fifth st. e. 180 feet	"	4
Charlotte ave., from Fourth st. w. 131 feet	"	3
Charlotte ave., from Woodward to alley e. of Third ave	"	4
Chase st., from alley e. of Russell st. to Riopelle farm	"	3
Chene st., from Congress to Fremont st	"	30
Chene st., from Atwater st. to Hancock ave	"	6
Chene st., from Theodore st. to 130 feet n. of Ferry ave	"	6
Chene st., from Harper to s. of Medbury ave	"	6
Cherry st., from Grand River to Trumbull ave. alley w. of	"	4
Cherry st., from National ave. to alley w. of Trumbull ave	"	3
Cherry st., from Twelfth st. e. 35 feet	"	4
Cherry st., from Harrison ave. to Twelfth st	wood	2¼
Chestnut st., from Russell st. to Elmwood ave	iron	4
Chipman st., e. of Nineteenth st	wood	2¼
Church st., from 107 feet w. of Tenth to Wesley st	iron	4
Church st., alley s. of, from Eighth to Tenth st	"	4
Clark ave., from Michigan ave. to Michigan Car Works	"	4
Clark ave., from River st. to Fort st	"	8
Clark ave., from Michigan ave. to M. C. R. R	"	6
Clark ave., in Car Works grounds	"	6
Clark ave., 2246 feet s. of Dix ave. to M. C. R. R	"	8
Cleveland st., e. of St. Aubin ave. 176 feet	"	4
Cleveland st., from 273 feet w. of Dubois to Chene st	wood	2¼
Cleveland st., from Chene st. e. 377 feet	"	3
Cleveland st., from Chene st. e. 377 feet to 582 feet e	"	2¼
Cleveland st., w. of Jos. Campau ave. 314 feet	iron	4
Cleveland st., from Jos. Campau ave. 400 feet e	wood	3
Cleveland st., crossing Elmwood ave. to alley e. of McDougall ave	iron	4
Cleveland st., e. of Elmwood ave. 650 feet	"	3
Cleveland st., from 650 feet e of Elmwood ave. e. 762 feet	"	4
Clifford st., from Park place to Sproat st	"	4
Clinton ave., from Gratiot ave. to Rivard st	"	10
Clinton ave., from Rivard to Orleans st	"	16
Clinton ave., from Orleans st. to Elmwood ave	"	8
Collins st., from Fremont st. to Gratiot ave	"	42
Collins st., n. of Fremont st. 563 feet	"	3
Collins st., s. of Fremont st. to Leland st	"	4
Collins st., from 563 feet n. of Fremont st. 559 feet	"	4

ION.	KIND.	DIAM. INCHES.
rd to Cass ave	iron	4
rd avenue to John R. st	“	6
to Beaubien st	“	4
i to Rivard st.	“	6
m Woodward to Cass ave	“	6
, 570 feet	“	3
t st. 57 feet	“	4
Putnam ave. n. 168 feet	“	6
Kirby st. n. 800 feet	“	6
Iolden ave. 214 feet	“	6
ave. s. 444 feet	“	6
oad s. of, 340 feet	“	6
n ave. n. 3,655 feet	“	6
Brush st	“	4
i ave. to Meldrum st	“	42
h to St. Aubin ave	“	24
ne to Mt. Elliott ave	“	4
. 171 feet	“	4
m Sixth to Seventh st	“	4
m 80 feet w. of Brush to St. Antoine st	“	4
m Griswold to Third st	“	4
m Fourth st. e. 250 feet	“	4
om St. Antoine to alley w. of Brush st	“	4
om alley w. of Woodward ave. to Shelby st.	“	4
om Shelby to Cass st	“	6
om Cass to Fourth st	“	4
om Fourth to Seventh st	“	8
om Seventh to Eighth st	“	4
om alley e. of Woodward ave. to 94 feet e	“	3
ave. n. 313 feet	“	4
st. n. 3,984 feet	“	4
Lothrop st	“	6
ham st	“	8
ave. n. 372 feet	wood	3
ave. n 40 feet	iron	4
road.	“	6
ne to Elmwood ave.	“	4
Lieb st.	“	4
e. 185 feet.	“	4
ave to Campan road	“	4
John R to Randolph st	“	4
ave. to Hastings st	“	4
300 feet	“	4
h st	“	4
o Thirteenth st	“	3
hird to Twenty-fourth st	“	4
to Twenty-second st	wood	2¼
ward to Cass ave	iron	4
st. 280 feet	wood	2¼
of Ferry st. 116 feet	“	2¼
ridge st. to Jefferson ave	iron	6
ave. s. 360 feet	wood	2¼
e st. 205 feet.	“	2¼
n to Pierce st	“	2¼
eph to Fremont st.	“	2¼
St. Antoine st	iron	4
ne to Russell st	wood	2¼
. to Aubin ave	iron	4
th st. to Artillery ave	“	10
er st.	“	6
ave	“	6
st. to Army ave	“	6
n to Campbell ave	“	4
ve. to Ladies' lane	“	4
s. to Franklin st	“	6
unt st	wood	2¼
Alfred st	“	3
Fremont st	iron	3
Hunt st	“	6
	“	4
t. to Warren ave.	“	4
h to Frederick st. 188 feet n	“	4
Endicott ave	“	4
d to Cass ave	“	4
116 feet	“	4

LOCATION.	KIND.	DIAM. INCHES.
Edmund place, from Woodward ave. to Brush st.	iron	24
Eighth st., from River st. to alley s. of Fort st.	"	4
Eighth st., from Fort st. to alley north	wood	2¼
Eighth st., from Baker st. to Michigan ave	iron	3
Eighth st., from Grand River ave. to Lysander st.	"	4
Eighth st., from Michigan ave. to Orchard st.	wood	2¼
Eighth st., s of Brigham st. 40 feet	iron	6
Eighteenth st., from Fort st. to Michigan ave	"	6
Eighteenth st., from Michigan ave. to Butternut st.	wood	3
Eighteenth st., from Mytle to Butternut st	iron	6
Eighteenth st., from Myrtle to Linden st	wood	2¼
Eighteenth st., n. of Linden st. 420 feet	iron	3
Eighteenth st., from 420 feet n. of Linden st. n. 98 feet	"	4
Eighteenth st., from 510 feet n. of Linden to Buchanan st	"	6
Eighteenth st., from Buchanan to 238 feet n. of Breckenridge st	"	4
Eighteenth st., from Kirby ave. s. 336 feet	"	6
Eighteenth st., from McGraw ave. n. 1107 feet	"	6
Eighteenth st., alley w. of, from Marquette st. n. 118 feet	wood	3
Eighteenth-and-a-half st., from River st. to Fort st.	iron	4
Eighteenth-and-a-half st., from River st. 504 feet s	"	3
Elizabeth st., from Hastings st. e. 390 feet to alley e. of Woodward ave	"	4
Elizabeth st., from alley e. of Woodward ave. to Brush st. n. and s. sides	"	24
Elizabeth st, alley n. of, from Cass ave. w.	"	3
Elizabeth st., alley s. of, from alley e. of Woodward av. to Witherell st	"	3
Elizabeth st., alley s. of, w. of Cass ave.	"	3
Ellery st., from Arndt to Berlin st	"	6
Eliot st., from Woodward ave. to Brush st.	"	4
Eliot st., from Russell to Riopelle st	"	4
Eliot st., crossing St. Antoine st.	"	4
Eliot st., crossing Hastings st.	"	4
Eliot st., crossing Russell st	"	4
Eliot st., crossing Rivard st.	"	4
Eliot st., from Brush to Beaubien st	"	4
Eliot st., from Beaubien to Russell st	wood	2¼
Elm st., e. of Twelfth st. to Harrison ave	"	2¼
Elm st., from alley e. of Trumbull ave. 320 feet e.	"	2¼
Elm st., from alley e. of Wabash ave. to Thompson farm	"	2¼
Elm st., from National ave. to alley w. of Trumbull ave	"	3
Elm st., from Seventh st. w	"	3
Elmwood ave., from Jefferson ave to Croghan st.	iron	4
Elmwood ave., from Croghan to Sherman st	"	6
Elmwood ave., from Gratiot ave. to Hunt st	"	6
Elmwood ave., from Hunt to Waterloo st.	"	4
Erskine st., from Woodward ave. to Brush st	"	4
F st, 188 feet w. of Vinewood ave.	"	4
Farmer st., from 15 feet s. to 38 feet n. of 30-inch main in Gratiot ave.	"	8
Farmer st., from Bates st. to Gratiot ave	"	6
Farnsworth st., crossing Russell st.	"	6
Farnsworth st., from Woodward ave. to Beaubien st.	"	6
Farnsworth st., crossing Moran st	"	4
Farnsworth st., crossing Grandy ave	"	4
Farnsworth st., w. of Moran st. 628 feet.	"	3
Farnsworth st., from 266 feet e. of Russell to Chene st.	"	4
Farnsworth st., from Beaubien to Russell st. 108 feet e	wood	4
Farnsworth st., from 108 feet to 266 feet e. of Russell st	"	2¼
Ferdinand ave., crossing Dix ave. n. 875 feet	iron	6
Ferdinand ave., from Fort st. 480 s. of	"	4
Ferdinand ave., 975 feet n. of River st	"	4
Ferry ave., from Woodward ave. to Russell st.	"	4
Ferry ave., from Russell st. e. 763 feet.	"	8
Ferry ave., from 7o3 feet e. of Russell to Dequindre st.	"	4
Ferry ave., from Dequindre st. to St. Aubin ave.	wood	3
Ferry ave., alley s. of, from alley w. of St. Aubin ave. 168 feet	"	2¼
Ferry ave., from St. Aubin to 109 feet e. of Jos. Campau ave.	iron	4
Field ave., from 1700 feet s. of Gratiot to Hendrie ave	"	6
Field ave., from Jefferson ave. to Linden Park ave	"	6
Fifth st., from alley n. to alley s. of Lafayette ave	"	4
Fifth st., from Labrosse st. to alley n.	"	4
Fifth st., from Michigan ave. to Noble st. on both sides of Elton and Crawford parks	"	4
Fifteenth st., from Fort to 165 feet s. of Marantette st.	"	6

	KIND.	DIAM. INCHES.
Marantette st. to Michigan ave	wood	3
e. to Myrtle st	"	2¼
Grand River ave	"	3
r ave. s. 83 feet	iron	4
chanan st	"	24
eet	"	6
rren ave	"	6
alley n	"	8
Front st	"	6
dge st	"	4
River ave	"	6
24 feet	"	3
Harper ave. n. 264 feet	"	4
Cass ave	wood	2¼
o Seventh st	iron	4
, to Twelfth st	"	4
e. to 28 feet w. of Twenty-seventh st	"	4
ve. to 324 feet w. of Rivard st	iron	4
. 166 feet	"	4
Dequindre to 377 feet e. of Chene st	"	4
re	"	4
w. 225 feet	wood	2¼
e. w. 717 feet	iron	4
ran st	"	4
o Griswold st	"	4
eenth ave	"	6
offman st	"	8
nty-fourth st	"	6
. to Artillery ave	"	8
to St. Antoine st	"	4
st. w. 185 feet	wood	–
mwood ave. e. 984 feet	iron	4
t	wood	2¼
eet	"	2¼
iott ave. w. 370 feet	iron	4
feet	"	4
e. to Baker st	"	6
y s. of Fort st	"	8
st. to Grand River ave	"	6
ave. to Bagg st	"	4
gham st	"	6
to Holden ave	"	4
uscola st. 87 feet n	wood	2¼
t	"	2¼
to Lafayette ave	iron	8
te ave. to Bagg st	"	10
to Grand River ave	"	8
iver ave. to N. Boulevard	"	6
to Frank st	"	3
eet	"	3
386 feet	wood	2¼
urth st	iron	4
to Beaubien st	"	4
to w. of Dequindre st	"	6
quindre st. to St. Aubin ave	"	4
McDougall ave	"	6
dair st	wood	2¼
eet	"	2¼
cDougall ave. to Walker st	iron	4
cDougall ave. to Walker st	"	4
to 185 feet w	"	4
w. 399 feet	"	4
n ave	"	4
to Dubois st	"	4
R st	"	4
ve. to Collins st	"	6
ve. to Collins st	"	42
Elliott ave	"	4
st	"	4
nd to Third st	"	4
road	"	6
ave. to Brush farm	"	4
St. Antoine st	"	4
Rivard st	"	4
859 feet	"	4

LOCATION.	KIND.	DIAM. INCHES.
Garfield ave., crossing Russell st	iron	4
Garfield ave., crossing St. Antoine st	"	4
Garfield ave., crossing Riopelle st	"	4
Garfield ave., e. of Riopelle st. 592 feet	"	8
Garfield ave., from 592 feet e. of Riopelle st. to Chene st. e. 47 feet	"	4
Garfield ave., alley s. of, w. of St. Aubin ave. 260 feet	"	3
Garfield ave., crossing Grandy ave	"	4
Garfield ave., from Grandy ave. to Chene st	wood	8
Goldner ave., from Michigan ave. to G. T. R. R	iron	6
Gilman st., from Cass to Grand River ave	"	4
Grand River ave., from Woodward ave. to Cass st	"	8
Grand River ave., from Cass to Third st	"	6
Grand River ave., alley n. of, from Lincoln ave. w. 47 feet	"	4
Grand River ave., from Third to 1,544 feet w. of Seventeenth st	"	8
Grand River ave., connecting with 30-inch main in line of Buchanan st. 22 feet	"	8
Grand River ave., from Brigham to Buchanan st	"	30
Grand River ave., alley n. of, from Trumbull ave. to alley w. of	"	6
Grand River ave., from 1,514 feet w. of Seventeenth st. to city line	"	6
Grand River ave., e. of Eighth st. 110 feet	"	3
Grandy ave., n. of Harper ave. 322 feet	"	4
Grandy ave., from 322 feet n. of Harper ave. to 185 feet n. of Trombly ave	"	6
Grandy ave., from Pierce st. to Harper ave	"	6
Grandy ave., from Gratiot ave. to Pierce st	"	4
Grant st. crossing Twelfth st	"	4
Grant st., from Twelfth to Thirteenth st	"	8
Granville st., crossing Wabash ave	"	4
Granville st., from Thirteenth to Wabash ave	"	8
Gratiot ave., from Woodward ave. to Brush st	"	10
Gratiot ave., from Brush st. to city limits	"	6
Gratiot ave., from Woodward ave. to Raynor st	"	30
Green ave., from Holden to Milwaukee ave	"	6
Griswold st., from Atwater to State st	"	6
Griswold st., from Atwater st. to river	"	8
Guoin st., from Orleans st. to Mullett farm	"	4
Guoin st., from Orleans st. to St. Aubin ave. 117 feet e. of	"	8
Guoin st., from Chene st. to Jos. Campau ave	"	4
Guoin st., from Jos. Campau ave. to Walker st	"	6
Hale st., from Riopelle st., to St. Aubin farm	wood	2¼
Hale st., from St. Aubin ave. w. 300 feet	"	3
Hale st., 275 feet e. of St. Aubin ave	iron	4
Hale st , from Jos. Campau to Grandy ave	wood	2¼
Hale st., e. of Dubois st. 524 feet	"	2¼
Hale st., w. of Dubois st. 162 feet	iron	8
Hale st., from 100 feet w. of Chene st. to Grandy ave	"	8
Hale st., crossing Riopelle st	"	4
Hamlin ave., from Woodward to Oakland ave	"	4
Hammond ave., from Toledo ave. to s. of L. S. R. R	"	6
Hammond ave., from 175 feet n. of Ranspach to 225 ft s. of Leavitt ave	"	6
Hancock ave., from Cass ave. to St. Antoine st	"	4
Hancock ave., crossing Fourteenth ave	"	4
Hancock ave., from Wabash to Fourteenth ave	"	8
Hancock ave., from Crawford to Seventh st	"	4
Hancock ave., from National ave. to Thirteenth st. w. 64 ft	"	4
Hancock ave., from St. Aubin ave. to Dubois st	"	4
Hancock ave., from Rivard to Riopelle st	"	4
Hancock ave., 281 feet w. of Chene st. to Grandy ave	"	4
Hancock ave., from Mitchell ave. e. 235 feet	"	4
Harper ave., from Hastings st. e. 563 feet	"	4
Harper ave., from Chene st. e. 147 feet	"	4
Harper ave., crossing St. Aubin ave. to Dubois st	"	4
Harper ave., crossing Grandy ave	"	4
Harper ave., w. of Grandy ave. 460 feet	wood	2¼
Harper ave., from Woodward ave. to 366 feet e. of St. Antoine st	iron	4
Harper ave., e. of Grandy ave. 576 feet	"	4
Harriet st., from St. Antoine st. to alley w. of Brush st	"	4
Harrison ave., from Michigan ave. to Grand River ave	"	4
Harrison ave., alley w. of from Linden n. to Linden st. s.	"	4
Harrison ave. from Merrick ave. to 343 feet n. of Kirby st	"	4
Harvey ave., from Junction ave. to 500 feet w. of Campbell ave	"	4
Hastings st., from Congress to Fort st	"	8
Hastings st., from Congress to Clinton st	"	6
Hastings st., from Congress st. s. 118 feet	"	8
Hastings st., from Champlain to Croghan st	"	8

TION.	KIND.	DIAM INCHES.
to Catherine st	iron	4
ne to Watson st	"	6
to Fremont st	"	10
t st. to Forest ave	"	8
rth to Ferry st	"	6
f Boulevard to Piquette ave	"	4
ve. to 20 feet n. of Boulevard	"	4
of Custer ave. 26 feet	"	4
to Piquette ave	"	6
m n. line of Boulevard n. 558 feet	"	3
ve. w. 150 feet	"	4
of Twelfth to 96 feet e. of Thirteenth st	"	3
teenth st	"	4
of Twelfth st. to 149 feet e	wood	2¼
ampau ave. e. 270 feet	"	2¼
ampau ave. e. 270 feet to 445 feet	iron	3
ood ave. 39 feet	"	4
ood to alley e. of McDougall ave	"	3
s. Campau ave	"	4
ave. to Croghan st	"	6
bin ave. to Dubois st	"	3
s st. to alley w. of McDougall ave	"	4
. of McDougall ave. to Elmwood ave	"	4
ard ave. 1,102 feet	"	4
ndy ave	"	4
ave. to Clifford st	"	4
o alley e. 190 feet	"	4
o Third st	"	6
Scotten ave	"	4
ave. to Beaubien st	"	4
. to A. Beaubien farm	"	3
farm to Russell st	"	4
iopelle st	"	3
ave. to Fourth st	"	3
lley w. of Trumbull ave	"	4
s. to alley w. of Trumbull ave	"	3
River st	"	8
ard to Cass ave	wood	4
Third ave	"	3
Fourth ave	iron	4
ave. to Crawford st	wood	3
d st. to Commonwealth ave	iron	4
ave	"	6
l ave. to Brush st	"	4
cotten ave	"	4
R. bridge to Twenty-fourth st	"	6
Twelfth st	"	4
an ave. to Myrtle st	"	6
f Myrtle st	wood	3
an ave. to E st	iron	4
. to 395 feet n. of Brandon ave	"	6
Crawford st	"	4
Grand River ave	"	4
igan ave. to L. S. R. R	"	4
tternut st	"	6
pau ave	"	4
bone st	"	4
alley w of McDougall ave	wood	2¼
cDougall ave. 35 feet	"	3
f McDougall ave	iron	3
85 feet e. of alley e. of McDougall ave	"	4
ve. to 15 feet e. of Ellery st	"	4
Walnut st	wood	2¼
to 295 feet s. of	iron	3
oine st	"	4
gs st	"	4
st	"	4
504 feet w. of w. line of Beaubien st	"	3
. of Beaubien to Russell st	wood	2¼
st. to St. Aubin ave	"	2¼
au ave. to Grandy ave	"	2¼
to Grandy ave	iron	3
Dequindre st	"	4
gall ave	"	4
ave. 241 feet and 180 feet	"	3 & 4

	KIND.	DIAM INCHES
	iron	4
ft	wood	3
	iron	3
	"	4
of Fourth to alley e. of Twelfth.	"	4
to Eighth st	"	4
h to Tenth st	"	8
k st	"	4
elby	"	4
wold to First st	"	6
st to Fourth st	"	4
h to Tenth st	"	4
s to Shelby st	"	4
lby st	"	3
st to Tenth st	"	6
s to First st	"	4
rteenth st. e. 190 ft	"	8
Twelfth st	"	4
8 ft	"	4
Tenth st. to M. C. R. R. bridge	"	3
ave	"	4
Fifteenth st	"	8
nth st. 820 feet	"	4
alley w. of Sixteenth st	"	4
t st.	"	4
ond st	"	4
rth st	"	4
o Twenty-fourth st	"	4
Twenty-second st.	"	4
ave.	"	4
n ave	"	4
	"	4
C. R. R.	"	6
st. e. 240 feet	wood	2¼
nd st.	iron	4
feet to w. of 562 feet	"	4
n. 1272 feet	"	6
n. 1968 feet.	"	6
	"	4
uindre st	"	4
alley w. of	"	8
	"	8
	"	4
iopelle st	"	12
lmwood ave	"	4
ott ave	wood	2¼
feet n. of Visgar st	iron	6
505 feet	"	6
bash ave	"	4
son ave	"	4
d st.	"	6
n st	"	3
	"	4
mplain st.	wood	2¼
ht st.	iron	6
feet	"	3
	"	4
	"	4
t e. of Russell st.	wood	2¼
eet.	iron	4
	"	3
et w. of Dubois st.	wood	2¼
to Mitchell ave.	"	2¼
ell ave.	"	2¼
is to 160 feet e. of Chene st.	iron	3
	"	4
ollins st	"	3
e.	"	4
t ave	"	4
	"	3
et.	"	3 & 4
1.	wood	2¼
h st. to Lognon farm	"	2¼
feet	iron	4
t.	"	3

LOCATION.	KIND.	DIAM. INCHES.
hell ave., from Fremont st. to Warren ave	iron	6
hell ave., from Harper ave. n. of 324 ft	"	4
hell ave., from 265 feet n. of Gratiot ave. to Fremont st	"	4
hell ave., from Gratiot ave. n. of 265 ft	"	6
roe ave., 375 feet s. of Farmer st	"	4
roe ave., 51 feet n. of Cadillac Square	"	6
roe ave., alley n. of, from alley w. of Randolph to Farmer st	"	6
roe ave., alley n. of Farmer st. to alley e. of Woodward ave	"	4
roe ave., alley s. of, from Randolph st. to alley n. of Michigan ave	"	4
tcalm st., from Woodward ave. w. 412 ft	"	4
tcalm st., from 40 feet e. of Park st. to Cass ave	"	3
tcalm st., from alley e. of Woodward ave. to Brush st	"	4
tcalm st., from Brush to Russell st	"	3
tcalm st.. alley s. of, from Beaubien st. w. 240 ft	wood	2¼
an st., from 225 feet n. of Hancock ave, to Farnsworth st	iron	3
an st., from Gratiot to 225 feet n. of Hancock ave	wood	3
an st., from Farnsworth st. to Medbury ave	iron	6
rell st., from s. side of Dix ave. 245 ft	"	6
rell st., from River st. 132 feet n. of Porter st	"	6
Elliott ave., from Gratiot ave. to city line	"	4
Elliott ave., from Gratiot to Mack ave	"	8
Elliott ave., from Mack ave. to Preston st	"	10
Elliott ave., from Preston st. to 1,125 feet s. of Waterloo st	"	8
Elliott ave., from 1,125 ft. s. of Waterloo to 148 ft. s. of Wight st.	"	6
lett st., from St. Antoine st. to Elmwood ave	"	4
lett st., from Gratiot ave. to Chene st	"	30
berry st., from Twelfth to Thirteenth st	"	4
tle st., from Grand River to Hubbard ave	"	6
oleon st., from Brush to Russell st	"	4
ional ave., from Michigan to Grand River ave	"	6
ional ave., from Merrick to 345 feet n. of Kirby ave	"	3 & 4
ional ave., from alley s. of Lysander st. to Putnam ave	"	6
ark st., 295 feet e. in Griffin's foundry	"	3
ark st., from Nineteenth to Twentieth st	"	6
teenth st., from Baker to Newark st	"	6
teenth st., from Fort to Baker st	"	4
le st., crossing Sixth st	"	4
le st., from Sixth to Seventh st	wood	2¼
le st., from Fourth st. w. 150 feet	iron	3
le st., from Crawford st. e. 360 feet	"	4
land ave., from Hamlin to Horton ave	"	6
ley st., w. of Twelfth st. 100 feet	"	3
hard st., from Sixth st. to Elton park	"	4
hard st., from First st. to Elton park	"	4
hard st., from Sixth to Trumbull ave	"	6
ans st., from Reservoir to Congress st	"	24
ans st., from Atwater st. to Jefferson ave	"	10
ans st., s. of Fremont st. 28 feet	"	30
ans st., from Fremont st. to Alexandrine ave	"	6
ans st., n. of Garfield ave. 252 feet	"	4
ans st., from Jefferson ave. to Reservoir	"	8
ans st., from Scott to Reservoir	"	30
ans st., from Trombly st. to Lyman st	"	4
st., from Clark to McKinstry ave	"	4
wa st., from Thirteenth st. e. 180 feet	"	3
ister road, crossing Woodward ave	"	4
ister road, from Woodward ave. to Russell st	wood	3
ister road, from Russell st. to 393 feet e. of St. Aubin ave	iron	6
ner ave., from Woodward ave. to w. line of Brush farm	"	4
ner ave., crossing Russell st	"	4
ner ave., crossing St. Aubin ave	"	4
ner ave., crossing Grandy ave	"	4
k place, from Michigan ave. to State st	"	4
k st., from Woodward ave. to alley s. of Columbia st	"	6
k st., from Henry to Peterboro	"	4
sons st., from Woodward to Cass ave	wood	2¼
ry st., from Sixth to Seventh st	"	2¼
ry st., e. of 10-inch main in Seventh st. 28 feet	iron	3
ry st., from alley e. of Trumbull ave. e. 300 feet	wood	2¼
ry st., from alley w. of Trumbull ave. to National ave	"	2¼
ry st., alley s. of, from alley e. of Trumbull ave. e. 276 feet	"	3
ry st., from Seventh st. w. 319 feet	iron	4
ry st., crossing Humboldt ave	"	3 & 4
erboro st., from Woodward to Cass ave	wood	2¼
rce st., w. of Dubois st. 172 feet	iron	3

TION.	KIND.	DIAM. INCHES.
hene st	wood	2¼
hene st. to 724 feet e. of e. line	iron	3
ve. to Dequindre st	wood	3
u ave. w. 27 feet	iron	3
os. Campau ave. w. 180 feet	wood	3
ational ave	iron	4
to Twelfth st	“	3
t	“	4
to alley e. of Third	“	4
of Fourth to Crawford st	“	4
e. w. 150 feet	“	3
eventh st	“	4
ard ave to Beaubien st	“	4
en to Hastings st	“	3
River st	“	4
ley e. of Trumbull ave	“	4
e. to alley e. of	“	6
to Welch ave	“	4
ve. e. 400 feet	“	4
nth st	“	4
th st	“	4
Fourteenth ave	“	4
of Twenty-third st. to Tillman ave	“	4
e. w. 271 feet	“	4
Hubbard ave	“	3
rth to W. Boulevard	“	4
rd to Twenty-fourth st	wood	2¼
nth ave	iron	4
st. e. 160 feet	“	4
w. 210 feet	“	3
alley e. of Thirteenth st. w. 120 feet	“	3
ve. e. 27 feet	“	6
ave. 172 feet	iron	3
st. to alley w. of Eighteenth st	wood	3
t st., 175 feet	“	2¼
ond st., 225 feet	iron	3
cond st. to Twenty-third st	“	4
to Twenty-first st	“	3
st., 130 feet	“	4
e. to 287 ft. w. of Second st	wood	3
ve. e. 313 feet	“	2¼
Elmwood ave	“	3
to Mt. Elliott ave	iron	4
ave. w. 235 feet	“	4
ave. w. 150 ft	“	4
l ave. to Twelfth st	“	4
nwealth to National ave	“	4
to Seventh st. 58 feet w	“	4
Woodward ave	“	4
ard ave. w. 60 feet	“	6
of Atwater st. to Jefferson ave	“	4
st. to Cadillac square	“	4
square to Atwater st	“	8
ave. to Congress st	“	6
m alley s. of Fort to Champlain st	“	4
om Gratiot ave. to alley n. of Croghan st	“	4
om Atwater st. n	“	3
iot ave	“	10
e. to Clinton st	“	4
is to Hammond ave	“	4
st. 408 feet	“	3
ord st	“	4
ave to 488 w. of Campbell ave	“	4
servoir to 30-inch branch	“	24
l w. sides	“	24
8 ft. w. of Lovett ave	“	4
to Jefferson ave	“	12
ave. to Atwater st	“	8
roghan st	“	3
s. 450 feet	wood	2¼
47 feet	iron	4
to Jay st	“	6
Fremont st. s. 218 feet	“	4
t st	“	8
to Hancock ave n. 27 feet	“	6

LOCATION.	KIND.	DIAM. INCHES.
elle st., from Adelaide to Winder st	iron	4
rd st., from Jefferson ave. to Atwater st	"	8
rd st., from Atwater to Franklin st	"	4
rd st., from Franklin st. to Jefferson ave	"	3
rd st., from Jefferson ave. to Congress st	"	4
rd st., from Jefferson ave. to Clinton st	"	10
rd st., from Mullett st. to Gratiot ave	"	10
rd st., from Gratiot av. to 146 feet n. of Garfield ave	"	4
rd st., from Farnsworth st. to 100 ft. s. of Warren ave	wood	3
rd st., from 100 ft s. of Warren to 235 feet s. of Hancock ave	iron	4
rd st., from Farnsworth to 221 ft. n. of Ferry ave	"	4
r st., from Campau st. to Artillery ave	"	6
r st., from Campau st. to Pleasant ave	"	8
st., crossing Clark ave	"	8
st., s. of Main in Detroit & L. S. Copper Works	"	4
st., from Sixth to e. of Fifth st	"	4
st., from e. of Sixth st. to M. C. R. R. crossing	"	8
st., crossing M. C. R. R. track 270 feet	"	6
st., from w. of M. C. R. R. crossing to 525 feet w. of Twenty-ourth st	"	8
st., from Third st. w.	"	4
st., from Ferry ave. n. 325 ft	"	4
st., from Twentieth to Eighteenth st	"	4
ena st., from Woodward ave. to Brush st	"	4
ena st., crossing Hastings st	"	4
ena st., crossing Russell st	"	4
ena st., from Brush to Beaubien st	"	4
ena st., from Beaubien to Riopelle st	wood	2¼
ena st., crossing St. Antoine st	iron	4
ena st., crossing Riopelle st	"	4
and st., from State st. n. 237 feet	"	6
and st., from State st. s. 187 feet	"	4
ell st., crossing Mullett st	"	8
ell st., from Congress to Croghan st	"	4
ell st., from Catherine to Gratiot ave	"	4
ell st., crossing Fremont st	"	10
ell st., from Watson to Fremont st	"	6
ell st., from Gratiot ave. to Watson st	"	4
ell st., from Fremont st. s. of Hendrie ave	"	10
ell st., from s. of Hendrie to s. of Piquette ave	"	8
ell st., from Pallister road to s of Piquette ave	"	6
ell st., alley e. of, from Fort to Chase st	wood	2¼
y st., from Twenty-second st. e	"	2¼
y st., from Twenty-second st. w. 200 feet	iron	4
y st., from Twenty-third to Twenty-fourth st	wood	3
lte ave., from Pallister road to alley n. of N. Boulevard	iron	4
st., from Jos. Campau ave. to 75 feet w. of Grandy ave	"	4
st., from Riopelle st. to St. Aubin ave	"	4
st., from Dubois st to St. Aubin ave	"	3
st., from Chene st. w. 435 feet to 499 feet e	"	3
st., from Chene to Orleans st	"	30
st., from Dubois st. e. 190 feet	wood	3
st., crossing Grandy ave	iron	3
en ave., from Fort to Dix ave	"	6
en ave., from Dix ave. to Buchanan st	"	8
eu ave., from Buchanan st. to Herbert st	"	6
nd st., 166 feet n. of Henry st	"	4
nd st., 205 feet n. of Milwaukee ave	"	6
nd st., from Bagg st. to n. of Prentiss ave	"	6
nd st., crossing Canfield ave	"	8
nd st., from Front st. to alley n	"	4
nd st., from alley n. of Jefferson ave. to Front st	"	6
nd st., from High to Henry st	"	4
nd st., from Michigan ave. to Plum st	"	4
nd st., from Fort st. to alley n	"	3
nd st., from 1,366 feet n. of Holden place 239 feet n	"	6
nd st., from Holden place 1,366 feet n	wood	3
nd st., from Holden place 1,000 feet s	"	3
nd st., alley e. of, from Prentiss ave. to alley s. of	"	2¼
n ave., from Sixth to Seventh st.	"	2¼
n ave., from Cass to Woodward ave	"	2¼
n ave., from Cass to Third ave	iron	4
n ave., crossing Seventh st	"	4
n ave., crossing Crawford st	"	4
n ave., from Crawford to Fourth st	"	3

ATION.	KIND.	DIAM. INCHES.
to alley n. of Lafayette ave	iron	8
to Grand River ave	"	8
of Lafayette ave. to Bagg st	"	10
om Spruce to alley s. of	"	3
iam st. 70 feet	"	8
iver ave. to Brigham st	"	6
n. of Lysander to Brigham st	wood	2¼
n. of Lysander st. to Warren ave	iron	6
. of Stanley st. n. 339 feet	"	6
y ave. s. 132 feet	"	6
ie of Buchanan st. to 444 feet n. of Brecken-	"	6
ie of Buchanan st. to 28 feet s. of Poplar st.	"	4
st. to 28 feet s. of Poplar st	"	6
od ave e. 20 feet	"	6
lge st. to Jefferson ave	"	4
o Woodbridge st	"	8
to Michigan ave	"	4
ave. to Jefferson ave	"	10
ge st. to Jefferson ave	"	8
son to Linden ave	"	6
rs st. to Elmwood ave	"	4
d ave to Clifford st	"	4
Labrosse to Bagg st	"	4
88 feet	"	8
r ave. n. 473 feet	"	4
of Grand River ave. to Brigham st	"	6
a st. 80 feet	"	6.8
65 feet n. of Brigham st	"	4
alley n	"	4
River ave. to McGraw ave	"	6
tte ave. to Myrtle st	"	6
from Lafayette ave. to Howard st	"	3
to Buchanan	"	8
nan st. to Grand River ave	"	10
rd ave. to Oakland ave	"	4
er ave. to Noble st	wood	2¼
. to Second st	"	4
d to Cass ave	"	4
eventh st	"	4
to alley w. of Trumbull ave	"	4
m alley e. of Trumbull ave. to alley w. of	"	3
ter to Congress e	"	8
rson ave. to Clinton st	"	4
ot ave. to Elizabeth st	"	4
beth to Adelaide st	"	6
aide to Watson st	"	8
ot ave. to Congress st	"	6
on to Eliot st	wood	2¼
to Farnsworth st	iron	6
tte ave. n. 445 feet	"	6
aukee ave. n. 378 feet	"	6
s. of Ferry st. 266 feet	wood	2¼
ter st. to Harper ave	iron	6
ombly ave	"	6
ress to Larned st	"	12
eenth st. 284 feet	"	4
lle st. to St. Aubin ave	wood	2¼
ampau ave. to Chene farm	"	2¼
of Dubois to 102 feet e. of Chene st	iron	3
et e of Chene st. to Grandy ave	"	4
opelle st		4
Dougall ave	"	4
igall ave. 438 feet	"	3 & 4
ll to Riopelle st	"	3
in to Townsend ave	"	4
st. to Trumbull ave	"	4
y to Twenty-first st	wood	3
to Welch ave	iron	4
to Washington ave	"	30
ich Washington ave	"	24
to Washington ave	"	10
rd to Cass ave	"	4
an ave. to Magnolia st	wood	3

LOCATION.	KIND.	DIAM. INCHES.
an ave., n. of Magnolia st. 190 feet	iron	3
an ave., crossing Butternut st.	"	6
an ave, from Buchanan st. s. 288 feet	"	6
an ave., from 288 feet s. to 270 feet n. of Linden st	"	6
nit ave., crossing River st. to Wabash R. R.	"	6
rior st., crossing St. Antoine st	"	4
rior st, crossing Grandy ave	"	3
rior st., from 196 feet e. of Collins st. to McDougall ave	"	4
rior st., from Gratiot ave. to 398 feet e. of Moran st.	"	4
rior st., w. of Grandy ave. 197 feet	wood	3
rior st., from 197 feet w. to 474 feet w. of Grandy ave	"	2¼
rior st., from St. Aubin ave. to 343 feet e. of Chene st	iron	3
rior st., crossing Hastings st.	"	4
rior st., w. of Beaubien st. 220 feet	"	4
rior st., crossing Russell st	"	4
rior st, w. of Rivard st. 437 feet	"	3
rior st., from Rivard to Russell st	wood	2¼
rior st., from Hastings to Beaubien st	"	2¼
rior st., from Hastings st. e. 359 feet	"	3
rior st. from Dequindre to St. Aubin ave	"	2¼
rior st., from alley e. of Riopelle to Dequindre st	iron	4
n ave., 1120 feet s. of Fort st	"	6
more st., from Harrison to Wabash ave	"	4
more st., from Grand River ave. w. 123 feet	"	6
more st., from National ave. to alley w. of Trumbull ave	"	4
ster st., from Mt. Elliott ave. w. 388 feet	"	4
ster st., from Beaufait to Bellevue ave	"	4
n st, from River st. to Baker st	"	8
n st., from Baker st. to Michigan ave	"	6
dore ave., from John R st. e. 402 feet	"	4
dore ave., from 226 feet w. of Beaubien st. to 249 feet e. of St. ntoine st	"	4
dore ave., from Russell st. e. 450 feet	"	4
dore ave., from Grandy ave. w. 195 feet	"	4
dore ave., from St. Aubin ave. w. 268 feet	"	4
l st., from River st. to alley n	"	4
l st., from Larned st. to alley s	"	8
l st., from Larned st. to alley n. of	"	6
l st., from Michigan ave. to High st	"	4
l st., from Michigan ave. to alley s. of Porter st	"	3
l ave., from Grand River ave. to Bagg st	"	8
l ave., from Bagg st. to Holden place	"	6
l ave., alley e. of, from Henry to Brainard st	"	4
l ave., from Brigham st. to Canfield ave	iron	30
l ave., crossing Brigham st. 60 feet	"	8
eenth st., from Grand River ave. to Linden st	"	6
eenth st., from Grand River ave. n. of, 499	"	4
eenth st., from Hazel to Magnolia st	"	6
eenth st., crossing Myrtle st.	"	6
eenth st., from Bagg st. n. 350 feet	wood	2¼
eenth st., from Porter st. to Bagg st	iron	6
eenth st., alley e. of, from Porter st. s. 121 feet	"	4
eenth st., from Hancock ave. n. 150 feet	"	4
eenth st., alley w. of, from Myrtle to 135 feet s. of Butternut st.	wood	2¼
ieth st., from Michigan ave. to Buchanan st	iron	6
y-second st. n. of Michigan ave. to 15 feet s. of Buchanan st	"	4
y-third st., n. of Michigan ave. 1,674 feet	"	6
an ave., from Michigan ave. to Buchanan st	"	6
lo ave., from Scotten e. 360 feet	"	4
lo ave., from Scotten to Clark ave	"	4
lo ave., from Clark to McKinstry ave	"	4
lo ave., from Junction ave. e. 592 feet	"	6
lo ave., from Campbell to Livernois ave	"	6
bly st., from Grandy to Mitchell ave	"	4
bly st., from St. Aubin ave. to Crystal st	"	4
send ave., from Jefferson ave. to 102 feet n. of St. Paul st	"	6
bull ave., alley e. of, from Plum to Sycamore st	"	6
bull ave., from Michigan ave. to Plum st	"	6
bull ave., alley w. of, from Pine to Myrtle st	"	4
bull ave., alley w. of, from Pine to Cherry st	"	3
bull ave., alley w. of, from Brigham st. to alley n. of Grand River ve.	"	6
bull ave., from Brigham st., to Forest ave	"	8
bull ave., from Forest to Kirby ave. n. 56 feet	"	6
bull ave., from Stanley st. to s. of L. S. R. R	"	6

ATION.	KIND.	DIAM. INCHES.
d River ave. to alley n	iron	6
en Place s. 350 feet	"	6
m Crawford st. e. 394 feet	wood	2¼
m Crawford st. e. 360 feet	"	2¼
st. e. 130 feet	"	2¼
s. of River st. to Lafayette ave	iron	4
to Baker st	"	4
Brigham st	"	6
a st. to Piquette ave	"	8
gan ave. to Fort st	"	6
s. of Rose st. 192 feet	"	3
t to Baker st	"	4
er to Standish st	"	4
Fort to Baker st	"	6
aker to Dalzelle st	wood	2¼
rt to 330 feet n. of Porter st	iron	4
feet s. of Baker st. to 419 feet n. of Dalzelle st	"	3
Baker st	"	4
chigan ave. s 1047 feet	"	6
feet s. of Michigan ave. s. 259 feet	"	3
chigan ave. to Ash st	wood	2¼
gnolia st. 286 feet	"	2¼
h to 286 s. of Magnolia st	iron	3
agnolia st. to 35 feet n. of Linden st	"	3
feet n. of Linden st. n. 315 feet	"	4
0 n. of Linden to Poplar st	"	4
cGraw to Kirby ave	"	4
Butternut st	"	6
Myrtle st	"	6
Buchanan st	"	6
aker st. to Michigan ave	"	8
utternut st. 14 feet	"	24
4 feet s. of Butternut st. s. 55 feet	"	20
7 feet s. of Butternut st. s. 85 feet	"	18
52 feet s. of Butternut st. s. 42 feet	"	16
94 feet s. of Butternut st. s. 34 feet	"	12
228 feet s. of Butternut st. to 8-inch main	"	8
River to Fort st	"	4
Fort to Baker st	"	6
uchanan st n. 359 feet	"	4
359 feet n. of Buchanan st. n. 887 feet	"	8
uchanan to Butternut st	"	10
cGraw ave. 318 ft	"	4
of, from Magnolia st. n. 130 ft	wood	3
higan ave. s. 730 ft	"	3
f, from Howard st. 114 ft	"	2¼
ker to Howard st	iron	4
den st. 192 ft	"	3
higan ave. to Linden st	"	6
ft. s. to 129 ft. n. of Buchanan st	"	6
ave. n. 1,110 ft	"	6
0 ft. s. of Michigan ave. to L. S. R. R	"	6
uchanan st. 804 ft	"	6
Dix ave. n. 990 ft	"	6
Michigan ave. to Buchanan st	"	6
Merrick to Kirby ave	"	6
Michigan ave. to Buchanan st	"	6
s. of Michigan ave. to 579 ft n	"	6
nden to Buchanan st	"	6
Fourth st	"	3
Mack ave	"	6
8 ft. e	wood	2¼
159 ft. w	iron	3
t to Buchanan st	"	24
t st. to 430 ft. n. of Toledo ave	"	6
t. to Visgar st	"	6
ar to Nall st	"	3
hanan to Nall st	"	6
hanan st. to Merrick ave	"	10
d to La Salle ave	"	6
R. R. to Michigan ave	"	6
gan ave. to Locust st	wood	3
st to Ottawa st	"	2¼
a to Poplar st	iron	4

LOCATION.	KIND.	DIAM. INCHES.
abash ave., from n. line of Grand River ave. to Poplar st	iron	4
abash ave., from Magnolia to Hazel st	wood	2¼
abash ave., from Grand River ave. to L. S. R. R	"	2¼
abash ave., alley e. of, crossing Myrtle st	iron	4
alker st., from Atwater st. to Jefferson ave	"	4
arren ave., from Cass ave. to St. Antoine st	"	4
arren ave., from Crawford to Seventh st. w. 106 ft	"	4
arren ave., 129 feet w. of Twelfth st	"	4
arren ave., from Fourteenth ave. to Sixteenth st	"	4
arren ave., from National ave. to Twelfth st	"	4
arren ave., from Crawford st. to Fourth ave	wood	2¼
arren ave., from St. Aubin ave. to Dubois st	iron	4
arren ave., from Second to Third ave	"	4
arren ave., from 300 feet e. of Russell to Rivard st	"	4
arren ave., crossing Grandy ave	"	4
arren ave., crossing Russell st	"	4
ashington ave., from State st. to Michigan ave	"	30
ashington ave., from Michigan to Grand River ave	"	10
ashington ave., alley w. of, from alley s. of Park to alley n. of Michigan ave	"	4
ashington ave., alley e. of, from alley s. of Park to alley s. of State st	"	4
aterloo st., from Gratiot to Jos. Campau ave	"	4
aterloo st., 562 feet e. of Elmwood ave	"	3
aterloo st., from 562 feet e. of Elmwood ave. to 410 feet e. of Ellery st	"	4
aterloo st., from alley e. of McDougall to Elmwood ave	"	4
aterloo st., from Mt. Elliott to 213 feet e. of Meldrum ave	"	4
atson st., from Brush st. to Reservoir	"	24
atson st., from Dequindre to Chene st	wood	2⅛
atson st , from Brush st. to Woodward ave	iron	4
ayne st., from Michigan ave. to Woodbridge st	"	6
ayne st., from Woodbridge st. s. 173 ft	"	4
ebster place, 276 feet w. of Nineteenth st	"	4
ebster place, 240 feet e. of Twenty-second st	wood	2¼
elch ave., from 534 s. to 2,808 feet n. of Michigan ave	iron	6
elch ave., from Plumer st. to n. line of M. C. R. R	"	6
elch ave., from 211 feet s. to 225 feet n. of Spark ave	"	6
esson ave., from 1,720 feet s. of Michigan ave. to Visgar st	"	6
esson ave , from Leavitt st. to L. S. R. R	"	6
esson ave., from Toledo ave. to L. S. R. R.	"	6
ight st., from Chene to Lieb st	"	4
ight st., from Lieb st. to 640 feet e. of Mt. Elliott ave	"	6
ight st., alley s. of 230 feet e. of McDougall ave	"	4
ilkins st., from Brush to Russell st	"	4
ilkins st., from Riopelle st. to Orleans st	wood	2¼
ilkins st.. crossing Riopelle st	iron	4
ilkins st., from Orleans st. to Dequindre st	"	4
ilkins st., from Dequindre st. e. 540 feet	wood	2¼
ilkins st., w. of St. Aubin ave. 172 feet	iron	4
ilkins st., from St. Aubin ave to 225 feet e. of Dubois st	wood	3
ilkins st., from Chene st. w. 375 feet	"	2¼
illiams ave., from 24 ft. n. of Buchanan st. to Michigan ave	iron	6
illis ave., from Woodward ave. to Beaubien st	"	4
illis ave., from Woodward ave. to Third st	"	6
illis ave., w. of Fourth ave. 30 feet	"	4
illis ave., crossing Seventh st	"	4
illis ave., from Jones farm to Crawford st	wood	2¼
illis ave., from Fourth ave. w. 295 feet	"	3
illis ave., from Sixth to Eighth st	"	2¼
illis ave., from Twelfth st. e. 215 feet	"	3
illis ave., crossing Twelfth st	iron	4
illis ave., from Beaubien st. to St. Antoine st	"	3
illis ave., 296 feet e. of St. Antoine st	wood	2¼
illis ave., 350 feet w. of Hastings st	"	3
illis ave., 356 feet e. of Hastings st	iron	4
illis ave., 332 feet w. of Rivard st	"	3
illis ave., from Russell st. e. 510 feet	"	4
illis ave., 36 feet w. of Russell st	"	3
illis ave., 320 feet w. of Russell st	wood	3
illis ave., from Riopelle to Dequindre st	iron	4
illis ave., from Dequindre st. to St. Aubin ave	wood	2¼
illis ave., 550 feet e. of St. Aubin ave	"	3
illis ave., 537 feet w. of Chene to Grandy ave	iron	3
illis ave., from Jos. Campau ave. to McDougall ave	wood	2¼

LOCATION.	KIND.	DIAM. INCHES.
randy ave....................	iron	3
itchell ave..	“	4
ougall ave. e. 291 feet..............................	“	4
dward ave. to Orleans st...........................	“	4
eteenth st. e................	wood	2¼
ubin ave. w.	“	2¼
of Dequindre st.....................................	iron	4
ams ave. to alley n.................................	“	3
ami to Adams ave...................................	“	4
odward to Miami ave..............................	“	6
Randolph to Brush st..............................	“	4
L. Beaubien farm to Russell st........	“	4
Orleans to 235 feet e. of St. Aubin ave...........	“	6
s. of Brush st. to A. Beaubien farm.............	“	3
s. of, from Bates to Randolph st..........	“	4
Woodward ave. to Griswold st.	“	6
Griswold to Second st...	“	4
First to Second st..................................	“	6
Jos. Campau ave. 292 feet..................... ...	“	4
Jos. Campau ave w.............	wood	2¼
Lieb st. w. 310 feet.............	“	2¼
n ave. e. 350 feet..................................	iron	4
Atwater st. to Adams ave.........................	“	8
Atwater st. 346 feet.............	“	3
Adams to Baltimore ave....	“	10
Baltimore to Pallister road.......................	“	8
Atwater st. s. 180 feet.............................	“	4
High st. to 200 feet n. of Fremont st............	“	4
Edmund to Bagg st.................................	“	24
e. of, from alley s. of Michigan ave. to alley n.	“	4
e. of, from alley s. of Jefferson ave to alley s. of	“	4
e. of, from Williams to Gratiot ave..............	“	4
e. of, from Gratiot ave to alley s. of.............	“	6
e. of, from Elizabeth st. to alley s............ .	“	3
e. of, from Montcalm to Columbia st....	“	4
w. of, from alley s. of Park st. to alley n. of	“	4
w. of, from alley s. of Fort to Congress st......	“	4
w. of, from Congress to Larned st........	“	8
w. of, from alley s. of Jefferson ave. to Larned st.	“	4
w. of, from alley s. of Jefferson ave. to Atwater st	“	4
w. of, from Montcalm to High st................	“	4
rand River ave. n. 200 feet......	“	4

left in diameter column signify logs laid previous to 1853, o 2 inches bore; but no record was kept of their size.